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ATLANTIC CONSULTING ECONOMISTS LIMITED

THE PRESENT AND FUTURE MARKETS FOR SLATE PRODUCTS

Prepared for:

The Newfoundland Department of Mines; and
Energy, Mines and Resources Canada

by

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The comprehensive list of sources in the appendix speaks for itself. To all those who gave time and effort to make information available for this survey we express our gratitude.

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SUMMARY

Introduction

Overview

Slate deposits in Newfoundland occur in each of three geologically distinct regions of the island and slate has been mined at different locations and various times since the mid 19th century. In addition to slate used locally, several thousand tonnes were exported annually between 1850 and 1906, when production ceased. It was resumed in 1986.

The Canadian government and the Government of Newfoundland and Labrador have joined in a review of the potential of Newfoundland's slate deposits as the basis for a viable industrial mineral industry in the province. The present survey of markets is part of that review and was commissioned under the auspices of the Canada-Newfoundland Mineral Development agreement.

Methodology

The survey is based upon material provided by the industry and by various government bodies, accessed via the overseas Canadian Trade posts. This statistical material was augmented by information derived from an extensive interview program by mail, phone and individual meetings, in which factual information and opinion was requested of respondents drawn from various categories in different parts of the world.

The Report

The report broadly summarizes the findings on the markets for slate, the influencing factors and the trends in evidence. The question of research and development is briefly taken up and the question of competing and substitute materials is discussed. Detailed trade statistics and a brief commentary on the markets are presented for each of the principal producing, exporting and importing countries.

The final chapters contain a discussion of the strengths and vulnerabilities of Newfoundland's industry followed by a suggested strategy for marketing and development.

Production and Trade

The world-wide production of dimension slate is in the range of 500 to 700 thousand tonnes each year. The world's largest producer of slate is Spain, whose production of dimension slate, principally for roofing, has increased from 100,000 to about 300,000 tonnes over the last seven years. World output has grown about 20 per cent since 1982, and reflects both a decline in some producing countries and a much higher rate of growth in Spain and others.

Most countries which produce major quantities of dimension slate also produce crushed slate, granules and

powders from the large amount of unmarketable small-sized slate which is a by-product of the quarrying and processing stages.

Of the world production of dimension slate, about two thirds is traded. Spain exports around 85 per cent of its output and Italy about half. In addition to the major exporting trade, smaller quantities are exported by a growing number of countries for the architectural slate markets, and these trading activities are having a major influence on the slate trade world wide.

The major importing countries are the traditional users of Western Europe. During the 1980's the UK and the US have become significant importers (relative to their domestic output) and Australia has emerged as a significant consumer of imported flooring slate.

Market Trends

Overview

The market for slate is primarily a construction market and is but a minor segment of the overall market for dimension stone. Production developments during the 1980's included advances in stone working methods which made thin, geometrically sawn slabs more cheaply and readily available. These have contributed significantly to the growth of

stone as a facing for internal and external walls, flooring and paving in building applications where requirements of prestige and style outweigh cost.

Architectural Influences

There is a wealth of alternative materials of all types for these applications, which gives the architect a high degree of choice in executing a chosen design. Amongst these alternatives, dimension stone is one of the more expensive. Nevertheless, particular architectural styles often favour the use of one kind of material over another and in the 1980's several separate architectural influences appear to be exerting mutually reinforcing effects on the revived use of stone. With respect to roofing, the post-modern style encourages the use of the sloping roof. The current emphasis on the incorporation of traditional/historic elements in urban redevelopments does likewise and a preference for natural colours and textures in any case favours the use of materials such as clay tile and slate. These effects are seen in the design of expensive homes in urban residential and commercial developments and in smaller office buildings and shopping plazas.

Preferences for natural materials also influence the use of stone in the facades and interior of public and commercial buildings. Different considerations of style play a part here. The incorporation of an outdoor impression within an atrium is a prevalent example and the paving of the concourses of major indoor shopping centres, again with an underlying outdoor theme, is another.

Area of Growth

The world-wide statistics, to the point that they are available, show moderate growth in slate consumption. There are, however, some very pronounced localized growth patterns. The strong growth in demand for roofing slate in the UK is an example; the growth in the use of slate for both roofing and other architectural applications in the US is another; flooring and paving in Australia is a third.

Industry Trends

The slate industry tends to be conservative. Some producers have undertaken considerable modernization however and introduced new technology in the 1980's. Others have yet to do so. Modernization has been stimulated by competition stemming from developments such as the improvements in Italian stone processing methods and Spain's rising export activity in roofing slate.

Competition between slate-producing countries is keen as

as a result of the rise and the diversification of trading activity in the 1980's. This increased production and trading activity from low cost countries tends to drive the established producers towards product specialization on the one hand and improved productivity on the other, while the lower value markets increasingly fall to the low cost exporters.

Competing Materials

Slate competes with many other natural stones for flooring and paving applications. Granite is the most durable but many other stones are used, often specific to a particular location where they are quarried. For interior applications marble is dominant. Competitive materials for hard flooring other than natural stone fall into two categories: bonded agglomerated stone products and ceramic tile. Ceramic is overwhelmingly the dominant material. The agglomerates however, in the form of pre-cast tile and slab with a great range of decorative effect, are being aggressively developed in many countries.

The range of competing materials for wall surfaces in "prestige" applications in some respects parallels the range of hard flooring materials. Ceramic tile is used in great variety both indoors and out. Marble and granite are the predominant natural stone products in these applications whereas slate is a minor contender. Agglomerated stone tiles

and glass blocks are also used in both indoor and outdoor applications and a wide variety of manufactured sheet materials is available. Precast concrete is still commonly preferred cladding material made attractive by virtue of cost and by ongoing development of improved properties.

With respect to roofing, competitive products in the prestige market on both sides of the Atlantic are many. They include: metal tiles and shingles; sheet metal, embossed to simulate tile; raised and metal sheeting; clay tile; and so on. The trend to use natural textures has also spurred the development of new and more realistically synthetic simulated slates and metal tiles which have the advantage of providing a lighter-weight roof installation and require less skilled installation labour.

Crushed, Powdered and Waste Slate

Waste rock presents a major disposal problem and there is considerable incentive to find ways to add value to it and realize some return on saleable by-products.

Slate, like shale and various clays, is used to produce light weight aggregate for concrete blocks and poured concrete. There is no technical preference for slate as a raw material and plants operate on the basis of the closest suitable raw material deposit.

Roofing granules are particles of inert opaque material designed to absorb radiation from sunlight which would otherwise degrade the asphaltic binder in roofing shingles and papers and render them brittle. In the US and Canada, the use of rock with a less plate-like fracture is preferred as a raw material for roofing granules, though considerable quantities of slate granules are sold for the purpose in Europe and the UK.

Slate powders are ground to several degrees of fineness, and sold for use as fillers in paints, rubber, plastics and asphaltic coatings and sealers. A specialty application for slate powders which has developed during the last few years is the production of man-made roofing slates. These are composites with acrylic or polyester resins as binders, which are aimed at the higher priced end of the man-made slate market.

Research and Development

Very little product development activity has been reported, entirely directed at the development of the bonded slate powder artificial roofing slates mentioned above.

Individual Markets

Slate in the United States is a roughly 30 million dollar business representing a market which consumes about 50 thousand tonnes of dimension slate per year. In 1985 and 1986 the value of slate imports grew by 25 to 30 per cent per year. Domestic production of slate had a modest growth rate of 10 per cent or so per year during the same period, though less than that in terms of tonnage. Imports accounted for around 35 per cent of slate sales in the US in 1983-84 and reached 40 per cent in 1986. 19 companies produced slate in the US in 1985 compared with about 35 in the mid seventies.

Canada's slate is all imported, apart from the early Newfoundland production. Broadly interpreting the data for 1983 and 1984 the US and Europe together ship about $900,000 worth of slate to Canada yearly(at customs valuation). Roofing slate now constitutes about 10 per cent of this total. Non-roofing imports fluctuate year by year, perhaps reflecting the varying effect of larger commercial contracts on the consumption of floor tile in any one year. Italy accounts for more than half the slate imported from the EEC.

The picture of the UK roof slate industry over the past three or four years is one of consumption rising at a rate of 20 per cent per year, with 70 per cent of this increase being supplied by imports. The consumption of slate for

architectural uses other than roofing is estimated to be about 3,500 tonnes in 1987 and is therefore the minor part of the market.

France is one of the world's largest users of worked dimension slate with a 1986 consumption of 207,000 tonnes, 152,000 tonnes of it imported. 90 per cent of the current consumption is for roofing products. Since the early 1970's, French production has decreased due to competition from cheaper Spanish slate and from other roofing materials such as clay and concrete tiles.

Spain's annual production of slate comprises about 300,000 tonnes of dimension slate, which makes the country the world's largest slate producer. Spain's three biggest quarries each produce more than 30,000 tonnes of roofing slate per annum. Of the total of 230,000 tonnes produced in 1985, 228,000 tonnes was exported and probably about 30,000 tonnes of domestic production was used for roofing applications within Spain. 1,000,000 tonnes or more of waste slate is co-produced for use in cement and aggregates.

In West Germany, production of all types of slate has decreased from a total of 270,000 tonnes in 1980 to 70,000 tonnes in 1985. In 1983, production was divided into around 10,000 tonnes of dimension slate and 77,000 tonnes of rough slate, powder and granules. Rough slate is supplied mainly by France and Portugal and the major single supplier

mainly by France and Portugal and the major single supplier of roofing/cladding slate is Spain, which exported 40,000 tonnes to West Germany in 1985.

No slate is produced within the Netherlands. In 1985, imports amounted to 35,000 tonnes, a large proportion of which comprised regular bulk shipments from Northern Norway for processing and export. Officially recorded exports are equivalent to about one tenth of the quantity of slate imported into the Netherlands each year. The growth area of the domestic slate market is in flooring, which accounted for 75 per cent of the slate used in 1985.

Italy's annual domestic production of slate is around 80,000 tonnes and the country exports 36,000 tonnes of this. Imports, mainly of rough slate from France, are around 8,000 tonnes a year, which places domestic consumption at 50,000 tonnes per annum.

Australia's use of slate, mainly flooring, has been growing over the last few years. In 1984/85 the country produced 12,000 tonnes of slate and imported 34,000 tonnes exporting very little.

Official Chinese statistics of slate production and trade were not available. Traders from the UK and US have reported a keen interest in the large deposits of slate in China and indicated that the country has large deposits of

slate. Trade delegations in both directions have been frequent. A recent entrant to the architectural slate trade, China offers her product at the lower end of the price range.

Potential for Newfoundland Slate

In the 1980's there has been marked growth in the markets for architectural slate in a few specific countries.It has been accompanied by greatly increased exporting activity by countries with relatively low costs, which has kept prices down, particularly in the lower quality and less specialized parts of the market. Some established producers have expanded and modernized to meet these conditions and are continuing to do so in 1988. They have many competitive advantages including economies of scale, established reputations and proximity to domestic markets.

Newfoundland slate currently in production, or readily available for production has certain limited advantages which, if carefully exploited, should allow it to compete in certain segments of the slate market in different countries.Broader participation in export markets is a necessity because of the relatively small Canadian demand, and the desirability of lessening the present dependence on a single US customer.

The movement of exchange rates predicted in the next few years will, however, tend to work against the Canadian exporter.

The present Canadian market in total (for all colours and types of slate) is somewhat less than the production projected in the short term in Newfoundland. About 10 per cent of it is roofing slate and the balance mainly in gauged floor tile. If gauged tile is put into production the producers will face a choice of marketing alternatives - to sell through established dealers or to compete with them in selling to retail chains and marketing to architects. There are arguments for and against each.

Development of a product identity and a reputation based upon specific characteristics and quality is important, and the formation of an alliance with another producer who is technically advanced and knowledgeable in the market, would be an advantage.

If additional producers were to come on stream in Newfoundland, some form of cooperative marketing mechanism would be almost essential, given the international nature of the market.

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INTRODUCTION

Slate is metamorphosed mudstone or shale in which geological pressures have developed layered structures. These lend themselves to being split into thin slices, exposing a textured natural cleft surface. Inclusion of various minerals determines the colour of slate; red from haematite, green from ferrous oxides and iron silicates and dark grey/black from graphite and pyrites. Light grey, blue-black, purple and other colours, in plain and mottled forms, also occur.

Slate deposits in Newfoundland occur in each of three geologically distinct regions of the Island and slate has been mined at different locations and various times since the mid 19th century. In addition to local use, mainly in the Trinity Bay area, between 2 and 4 thousand tonnes of slate were exported annually to the UK between 1850 and 1906, when production ceased.

Since that time, entrepreneurs and mineral rights holders have expressed periodic interest in the Newfoundland slate deposits. This led to the reopening of one previously worked quarry which is situated at Nut Cove in Trinity Bay on the Northeast coast of the Island. Production during the first three years of operation has been destined mainly for the US market.

With a view to supporting the initial operation and encouraging further initiatives where feasible, the Canadian

government and the Government of Newfoundland and Labrador have joined in a review of the potential of Newfoundland's slate deposits as the basis for a viable industrial mineral industry in the province. The present survey of markets is part of that review and was commissioned under the auspices of the Canada-Newfoundland Mineral Development agreement.

Scope of the Survey

The Terms of Reference (Appendix Z) contain a comprehensive list of sub-topics which were grouped initially into five areas for enquiry.

1. Demand: current consumption and factors influencing trends in demand.
2. Commercial Factors: the structure of the industry as it affects markets and marketing practices; transportation; tariffs and currency values.
3. Technical Factors: both in the production of slate products and in end-use.
4. Market Development: The potential for broadening the range of applications for slate products and considerations of associated strategy.
5. Product Research and Development: a survey of development in progress and a strategy for future work.

In fact, the approach to the survey implied by these groupings was modified considerably, and is outlined below.

Methodology

Literature on the world slate industry is sparse. A computerized search of nine databases yielded very few recent significant references beyond a single comprehensive article by J. Robbins in Industrial Minerals, May 1986. The survey is therefore based upon material provided by the industry and by various government bodies, accessed via the overseas Canadian Trade posts. This statistical material was augmented by information derived from an extensive interview program by mail, phone and individual meetings, in which both factual information and opinions were requested from respondents drawn from numerous categories in various parts of the world (Appendix A).

Nomenclature caused difficulties. For example in certain instances roofing slate is included in the definition of dimension slate; in others the two are categorized separately. Flagging and cutting stock (unsawn and roughly split slate) although of relatively low value, has been included where the dimension stone statistics specifically include it, as in the US. Large volumes of crushed slate, granules and powder obscure the statistics of many countries and these materials have been discussed separately where possible.

The valuation of slate which is traded between countries poses similar difficulties of interpretation. The survey, for the most part, uses the quoted customs values

from the various national import data and CIF figures where a more valid comparison with domestic product values is desired.

The survey has encountered many difficulties in manipulating production and trade statistics from various sources. To obtain good estimates in reasonable agreement, verification of the figures was sought by follow-up telex and telephone contact with trade posts and with companies engaged in the slate business. Information on markets and product characteristics was also elicited where possible, though the level of detail available varied. Members of the slate industry are understandably reticent in market matters.

The Report

Chapter 2 summarizes global slate production and trade. Countries are ranked by the quantities (tonnages) of slate produced, exported or imported and the proportions of dimension slate versus by-product discussed. Very little specific information was obtainable within the scope of the survey on developments in production and processing, though some references are given in sections in specified countries.

Chapter 3 broadly summarizes the findings on the markets for slate, the influencing factors and the trends in evidence. The question of research and development is taken up at this point and the question of competing and substitute materials is discussed.

More detailed market and trade data for each country covered in the survey are presented in Chapter 4. These countries comprise significant producers in the slate trade on the one hand and consuming countries (which may be major slate consumers or those which offer possible market niches to a Newfoundland producer) on the other. Some observations in the structure of the industry are included in this country-by-country discussion.

The first part of Chapter 5 contains a discussion of the strengths and vulnerabilities of Newfoundland's industry vis a vis the different markets for slate, the nature of the competition, the transportation situation, and the projected trends in foreign exchange rates. The second part of the Chapter outlines a suggested marketing and development strategy.

Finally, the conclusions drawn from the study are presented and discussed in Chapter 6

PRODUCTION AND TRADE

Production

The world-wide production of dimension slate is in the range of 500 to 700 thousand tonnes each year. Overall output has been rising about 5 per cent per year since 1982 despite year-to-year fluctuations and shifts in the distribution of production.

The world's largest producer of slate in Spain, whose production of dimension slate, principally for roofing, has increased from 100,000 to about 300,000 tonnes over the last seven years. The other slate producing countries of the world produce around 350,000 tonnes of dimension slate each year. No information was available on production from the USSR and Eastern Europe and no trading figures are recorded.

Most countries which produce major quantities of dimension slate also produce crushed slate, granules and powders from the large amount of unmarketable small-sized slate which is a by-product of the quarrying and processing stages. In some cases old stockpiles of waste slate are being reworked to produce these materials.

Crushed, milled and sized products are relatively low-value materials which are therefore sensitive to transportation costs. However, considerable trade takes place between countries in slate granules for roofing products,some in flagstone and some in slate powders which are used as fillers in roofing products and in the

manufacture of plastics and resins.

The production figures for crushed and ground slate often outweigh those for dimension slate and obscure the statistics for both categories. Spain and the UK are two examples of countries whose government data do not always make the distinction. Interpretation is also made difficult by the inclusion of man-made products such as slate-containing synthetic roofing tiles in the data for natural slate.

The way in which these uncertainties are interpreted have a pronounced effect upon the overall picture of trends in the world-wide slate industry (Table 1).

Table 1: Dimension Slate Production by Country (tonnes)

	1982	1983	1984	1985	1986
Spain[1]	195,000	212,000	277,000	258,000	n/a
Italy[2]	76,000	76,000	80,000	86,000	86,000
FRG[3]	n/a	10,000	n/a	n/a	n/a
France[4]	70,000	46,000	59,000	58,000	58,000
South Africa[5]	44,000	40,000	45,000	n/a	n/a
US[6]	37,000	45,000	35,000	37,000	n/a
Norway[7]	33,000	33,000	33,000	33,000	33,000
UK[8]	n/a	19,000	22,000	24,000	26,000
Portugal	33,000	29,000	45,000	22,000	24,000
Belgium/Lux[9]	20,000	20,000	20,000	20,000	20,000
China[10]	1,500	5,000	8,000	8,000	14,000
Australia	11,000	11,000	12,000	12,000	11,000
India	6,800	6,000	7,700	8,600	6,500

Source: Official government statistics unless otherwise indicated

[1]Government export figures plus 30,000 tpa estimated domestic consumption (Industrial Minerals, May 1986) - for want of additional information. 1986 production about 300,000 according to trade comments in UK.

[2]1984 figures estimated in Industrial Minerals, May 1986. Other years based on government export figures plus 50,000 tpa estimated consumption.(ibid)

[3]Industrial Minerals, May 1986.

[4]Government production statistics. Industrial Minerals, May 1986. quotes 64,000 tonnes for 1984.

[5]Production data from Industrial Minerals, May 1986; Source: South Africa Minerals Bureau.

[6]1984 figure from personal communication. The 1984 figure from Dimensional Stone, July/August 1986, indicates a figure of around 48,000 tonnes.

[7]Norwegian production is estimated as indicated on page 137.

[8]UK Production is estimated as indicated on page 83.

[9]Production is estimated as indicated on page 122.

[10]Available destination country import figures which constitute a minimum level of production.(p.153)

In addition to the countries listed in Table 1, other European countries such as Sweden produce small quantities of slate. Several African countries also produce slate as do Taiwan, Korea, New Zealand and some South American countries. Of these, Brazil has been apparently been a consistent producer for several years and annual imports of about 1,000 tonnes are recorded in the US trade statistics.

The Netherlands, Eire, Hong Kong and Japan are among the countries which do not quarry or mine slate. These countries are among those which rely on imports.

Exports

Of this world production, the larger part is traded (Table 2). Spain exports around 85 per cent of its output and Norway, 75 per cent. West Germany would appear to export more slate than the country produces, due to the inclusion of slate-containing products such as man-made roof tiles.

Over the period 1982 to 1986 there has been an overall increase in the tonnage of slate exported. This is most marked in the case of Spain. Exports from Norway, Portugal, the Netherlands and France were stable. Those from the UK peaked in 1984 and fell by 3,000 and 5,000 tonnes in 1985 and 1986 respectively. The slate exporting activity of Italy, India and Belgium/Luxembourg all increased during the period as did that of West Germany in respect of slate and slate-containing products (Table 2).

In addition to the major exporting trade, small quantities were exported by a number of other countries including Australia, Yugoslavia (Appendix N).

Other countries in Africa, Asia, South America and Australasia also possess slate deposits. In some cases, these are being mined and the undeveloped state of such economies has led to export, rather than local use of slate, as in the case of India.

Table 2: Slate Exports by Country (tonnes)

	1982	1983	1984	1985	1986
Spain	165,000	182,000	247,000	228,000	n/a
France	66,000	35,000	39,000	46,000	44,000
Italy[1]	26,000	26,000	28,000	36,000	36,000
Norway	27,000	24,000	28,000	25,000	25,000
South Africa	9,600	8,100	13,600	17,400	n/a
FRG[2]	n/a	13,000	18,000	22,000	18,000
China[3]	1,500	5,000	8,000	8,000	14,000
India	8,400	7,900	10,000	12,000	n/a
UK[4]	6,800	10,000	13,000	10,000	5,100
Portugal	9,000	8,500	8,500	9,400	n/a
Belgium/Lux	2,700	4,400	3,300	3,600	5,400
US[5]	3,000	2,500	2,100	3,100	n/a
Netherlands	4,400	4,000	3,900	3,500	3,500

Source: Official government statistics unless otherwise indicated.

[1]The 2514 component of the 1982 and 1983 figures is estimated at 3,000 tonnes based on the figures from 1984 to 1986.
[2]Includes appreciable quantities of articles of agglomerated slate.
[3]Minimum tonnages, estimated from other countries' import statistics (p 153).
[4]1982 & 1983 figures from Industrial Minerals, May 1986.
[5]Derived from USBM Yearbooks at an assumed average customs value of C$735 per tonne in all years.

There is a certain amount of re-export to third countries. This may follow processing within the second country or may be slate passing through on its way to a final destination. On occasion, rough slate is exported from one country, processed in another and the worked slate returned to the original country where it was mined (e.g. Portuguese slate for billiard tables). The raw data does not permit full interpretation of these movements.

Imports

The traditional users of Western Europe constitute most of the major importing countries. Here, the slate industry has been in decline and recent demand has required that production be supplemented by imports. Hong Kong is one example of an importer outside Europe which serves purely as an entrepot/processor nation. Its slate industry is fed entirely by imports.

During the 1980's the UK and the US have become significant importers (relative to their domestic output)and Australia has emerged as a significant consumer of imported flooring slate (Table 3).

Table 3: Slate Imports by Country (tonnes)

	1982	1983	1984	1985	1986
France[1]	134,000	139,000	174,000	157,000	152,000
FRG[2]	n/a	70,000	103,000	101,000	107,000
Netherlands	41,000	36,000	48,000	35,000	39,000
Belgium/Lux	32,000	28,000	36,000	39,000	39,000
Australia[3]	9,300	19,000	23,000	34,000	31,000
UK[4]	9,400	16,000	26,000	22,000	29,000
US[5]	16,000	11,000	14,000	19,000	24,000
Italy	n/a	n/a	n/a	7,900	8,800
Denmark[6]	n/a	n/a	n/a	7,000	n/a

Source: Official government statistics unless otherwise indicated.

[1]May be inflated by re-exports. (Industrial Minerals, May 1986, p.26).

[2]Includes 60 per cent rough slate (2514).

[3]Estimated from square metres.

[4]1982 and 1983 figures from Industrial Minerals, May 1986.

[5]Derived from US Dept of Commerce import figures at an assumed average customs value of C$547 per ton in all years.

[6]Approximate; 5,000 (Norway), 1,300 (Portugal), 64 (Spain).

Over the period 1982 to 1986, recorded importing levels have generally increased, as have recorded exports. During 1985, exports of 424,000 tonnes correspond approximately with imports of 422,000.

Anomalies, similar to those experienced with the export figures, arise with respect to import statistics. In addition, many more countries receive slate than supply it. Table 3 shows the major importers.

The figures for France are inflated by slate in transit (p 102) and those for West Germany by aggregates and slate-containing articles (p 117).

A number of countries import less than 2,000 tonnes per annum. Those recorded in the available data as importing between 1,000 and 2,000 tonnes in 1985 are Norway, Switzerland, Eire, Andorra, Finland and Sweden. A selection of countries which imported less than 1,000 tonnes that year are listed in Appendix N.

MARKET TRENDS

Overview

The market for slate is primarily a construction market and is a minor segment of the overall market for dimension stone. Stones such as granite, marble, limestone, sandstone, and to a much smaller degree slate, are traditional building materials which have been employed in cubic form over the ages. Slate's particular quality of cleavage into thin slices, while not unique, is more accentuated than in most other stones and this leads to its use in roofing tiles, as wall tiles and panels and as paving and flooring, often in combination with other types of stone. These applications in turn lead to its use in complementary forms in the manufacture of sills, copings, gutters, curbstones and shaped elements of building facades.

Although the survey was primarily concerned with the architectural demand for slate, there are two other significant areas of use which must be noted: billiard tables and writing slates or boards. The quantities of slate which are used for the manufacture of billiard tables form a significant fraction of overall slate consumption. Italy, and to a lesser extent Portugal, today supply virtually all of this market. The use of slate for blackboards is now a specialty industry in the Western world (there is one manufacturer in the US). Writing slates for hand-held use

are produced in Hong Kong and in mainland China itself.

Changing Technologies and Competing Materials

The property of producing thinly sliced planes, which originally gave slate an advantage in particular applications, is now emulated by many man-made materials as well as some natural stones. In the case of natural stones, production developments during the 1980's included advances in stone working methods which made thin, geometrically sawn slabs more cheaply and readily available. These contributed significantly to the growing use of dimension stone as a facing for the internal and external walls of large buildings.

Competing stone materials have generally derived greater benefits from the new technologies than has slate. Granite and marble cutting and polishing operations are becoming more automated, reducing the price of the material to the end-user. Slate quarrying and processing, on the other hand, remain labour-intensive. Nevertheless, the increasing use of dimension stone in slab form for architectural applications has positively affected the use of slate for the same purposes.

Architectural Styles

Roofing

The wealth of alternative materials of all types gives the architect a high degree of choice in executing a chosen design. Amongst these alternatives, slate is one of the more expensive. Nevertheless, particular architectural styles often favour the use of one kind of material over another. As an example, in the current post-modern vogue, the use of angled and curved forms is prevalent. In this style, the return to pitched and gabled roofs appears to be an influence in extending the use of slate and other tiles as roofing materials. According to commentators in the US and the UK there is a strong trend towards the use of natural-look materials which is also a major influence on the design of roofing. It is in evidence, for example, in the design of low-rise commercial and multi-unit residential properties on both sides of the Atlantic.

At the same time a number of factors have led to an increasingly traditional approach to the architectural treatment of roofs. The growth of heritage preservation consciousness in many countries has encouraged the use of traditional building materials. The redevelopment of historic areas in cities (whether publicly or privately initiated) encourages the use of materials and styles traditional to those areas both in restoration and in new building in adjoining areas. In the case of the private sector, this movement reflects a number of factors: the return to city core living by people with higher income levels; the con-

tinued redevelopment of downtown and waterfront areas for general commercial purposes; and restoration for the benefit of tourism development.

Thus, several separate architectural influences appear to be exerting mutually reinforcing effects on the revived use of roofing tiles. The post-modern style encourages the use of the sloping roof; current emphasis on the incorporation of traditional/historic elements in urban redevelopments does likewise; and a preference for natural colours and textures favours the use of materials such as clay tile and slate. These effects are seen in the design of expensive homes (principally in the US), in urban residential and commercial developments and in smaller office buildings, shopping plazas, exclusive sports clubs and the like.

Concurrently, the trend to natural textures has also spurred the development of new and more realistically synthetic simulated slates and metal tiles which have the advantage of providing a lighter-weight roof installation and require less skilled installation labour. It is very a common observation, particularly in the US, that slate would have a much wider acceptance as a roofing material if skilled labour were not so problematic.

Flooring and Walls

Architectural trends other than those in roof design have had some influence on the use of slate and similar materials in building. Most North American commentators

agree that there is a strong preference at present for the use of light colours in both domestic surroundings and public spaces. Even so, the current treatment of the internal and external spaces of major office and commercial complexes encourages the use of natural stone of various colours as flooring, paving and wall panelling for interior and exterior use. The style which incorporates an outdoor impression within an atrium is a prevalent example. The paving of the concourses of major indoor shopping centres, again with an underlying outdoor theme, is another. Although this type of application represents perhaps 5 per cent of slate consumption, it is a high-priced, well-publicized and visible portion and establishes trends which may influence the treatment of spaces in smaller public buildings and residences too.

Some countries are experiencing growth in the use of stone flooring residential construction. In Australia in particular, slate is taking a major part in this development.

Areas of Growth

The worldwide statistics up to the point that they are available (variously 1985 or 1986), moderate growth in slate consumption. There are, however, some very pronounced localized growth patterns. The strong growth in demand for roofing slate in the UK is an example; the growth in the use of slate for both roofing and other architectural

applications in the US is another; flooring and paving in Australia is a third. Although overall consumption is stable in other major consuming countries, specific products in particular areas may well have the potential to gain at the expense of competitive materials.

In areas where slate has been used in quantity over the years there is a tendency to perpetuate traditional uses. West Germany, for example, which has utilized slate roofing over a long period has continued to do so with little growth in flooring or cladding. Where slate was used predominantly in flooring, as in the Netherlands, slate roofing continues to be a minority application.

Significant growth of a market segment is often attributable to a change in circumstances particular to that locality. Examples are: an increase reported in natural stone flooring in Switzerland due to the trend towards under-floor heating; the increase in the use of slate roofing tiles in the UK and West Germany since asbestos products were withdrawn from the market; the subsidy program in the UK; and the replacement of flammable roofing with slate and other non-flammables in California.

Industry Trends

The slate industry tends to be conservative. Some producers have undertaken considerable modernization however and introduced new technology in the 1980's. Others have yet to do so. Modernization has been stimulated by competition

stemming from developments such as the improvements in Italian stone processing methods and Spain's rising export activity in roofing slate.

In the UK, all sizes of established producers have benefited from the escalation of interest in slate as a roofing material. With the current level of demand, UK quarries are producing to capacity and several are carrying out expansion plans. Keener price competition between domestic products and imports can be expected as UK capacity is further increased and producers try to regain lost market share.

In the US, flooring and architectural slate constitute a higher percentage of overall production. Competition from imported roofing slate therefore has proportionally less impact. Nevertheless, the industry has seen a number of closures and some regrouping in recent years. The US slate industry is also particularly vulnerable to imports in West Coast markets, because of the severe cost penalty imposed by road shipments or shipments by sea in US vessels. Producers say however, that both flooring and roofing slate production were increased in 1987, and production is very easily swung from flooring to roofing slate, and vice versa, to meet changed demand or specific opportunities.

In the Federal Republic of Germany, modernization of slate mines is reported and at least one major producer is working at capacity. The French industry predicts no major changes in market. In Spain, from which comes a very high

proportion of West German and French slate supplies, the steadily rising production of roofing slate for exports faltered in 1985. This lost volume was recovered during 1987 and is predicted to hold in 1988.

Competition between slate-producing countries is keen as a result of the rise and the diversification of trading activity in the 1980's. China, India and Brazil are among the countries which have entered the market in recent years and are increasing their exports. Other developing countries with slate deposits may well join the ranks of producers for export. In the absence of protectionist actions, the effect of increased production and trading activity from low cost countries will be to drive the more conservative established producers towards product specialization on the one hand and improved productivity on the other. This direction has already been taken by the more technically aggressive firms in the industry. One can expect that the lower-value markets will increasingly fall to low-cost exporting countries and that low-cost imports may well engender expansion in that segment of the market. This might in turn raise consumer awareness of slate products and perhaps positively affect the slate market overall.

Competing Materials

Slate (like other natural stones) performs well in

applications requiring structural strength, wear-resistance and impermeability. Its principal functional uses are therefore in building and landscape construction, and its stylistic and decorative uses also fall naturally into architectural applications.

In today's architectural construction, slate is almost entirely used in sheet or slab (as opposed to cubic) form and competes with an ever-changing range of natural and man-made materials, continually developed to satisfy the changing needs of the architectural market.

Flooring and Paving

Outdoor paving applications use stone by virtue of the enduring and impermeable surfaces it affords. Such surfaces are self-cleaning in rain (or easily washed), quick drying, and resistant to wear and atmospheric attack of various kinds over long periods.

The principal competitors for natural stones outdoors (other than asphalt paving and loose aggregate surfaces) are poured concrete and precast concrete slabs and pavers, clay bricks and, increasingly, concrete bricks. These materials, though less expensive, are to various degrees inferior to natural stone in their resistance to surface deterioration from atmospheric and salt corrosion, spillage, and freeze-thaw cycles. It must be noted though, that slate outdoors has a poor reputation with respect to edge deterioration from freezing and thawing.

Slate competes with many other natural stones for outdoor paving applications. Granite and marble are the most used in dimensioned form for paving, but many other stones are used, often specific to a particular location where they are quarried. Surfaces can be sawn, sanded, honed, polished or natural cleft, and stones may be used in squared or crazy paving form. The choice is a matter of compromise between aesthetics, function and price. Some comparative average installed costs are presented below.

(a) US locations.
Exterior slate paving: US$12.70 - 16.30/sq ft

(Source: Building Construction Cost data: 1987)

(b) Newfoundland.

Exterior slate in sand bed	C$ 8-12 sq ft
Paving brick in sand bed	C$ 4/sq ft.
Concrete Patio Stones in sand bed	C$ 3/sq ft.

(Costs do not include bed preparation)

(Source: Del Tile Ltd.)

With respect to interior applications, the various sheet vinyl products and, to a lesser extent reinforced vinyl tiles, have a major share. Though inexpensive, this type of flooring has limitations. The main functional advantages of slate in indoor flooring (again in company with other stones) occur in high traffic areas and in high spillage areas where aesthetics are important. The lobbies and stairways of public buildings, the serving areas of large eating establishments and public concourses in shopping malls are typical examples. Where abrasion

resistance is of major importance, correctly chosen slate falls between granite and marble. Otherwise the choice of stone will be determined partly by function - such as the non-slip properties - but largely by the aesthetics required in the building design and by cost.

In these interior applications, competitive materials for hard flooring other than natural stone fall into two categories: bonded agglomerated stone products and ceramic tile. Agglomerated stone cast-in-place seems to be very little specified today since finishing labour costs are high for this type of construction. On the other hand, resin bonded agglomerates in the form of pre-cast tile and slab - some with fibre reinforcement and all with a great range of decorative effect - are being aggressively developed in many countries.

In the case of ceramic tile, there is a range of products and prices which parallels the range of stone products, from the cheapest slate to the most expensive granite. Colours and decorative effects are virtually unlimited, from the highly figured and pictorial, to the natural earth-tone effects of quarry tile. Surfaces may be glazed or matt, according to function, but with fashion being a major influence. The availability of the larger sizes of ceramic tiles has increased in recent years, largely stemming from the influence of manufacturers in Italy where the use of the "monocottura" method of firing

allows economical production of 12 x 12in and larger tiles without warping.

Whereas areas in public and commercial buildings present very specific requirements for aesthetics combined with abrasion resistance and low absorption, the requirements of the residential market are less dictated by function. Bathrooms and kitchens can be carpeted; entrance halls polished wood; and so on. The residential market for hard floorings in general - and slate and other stones in particular - is more influenced by architectural fashion and current status symbols than it is by function. This is particularly true at the high priced end of the market but also influences the materials used in new building and in re-modelling and upgrading in the housing market as a whole. Here broadloom carpet, carpet tile and the various vinyl sheet and tile floorings are the competitive materials.

Comparative installed cost data per square foot are shown below.

(a) (US locations 1988).
Interior Slate Flooring: US$11.15 - 15.15.
(Source: Building Construction Cost Data: 1987).

(b) Newfoundland (commercial contracts)

Marble 12 x 12 x 1/4 in	C$18 - 33
Reconstituted stone tile, 12 x 12in x 1/4in	C$11 - 20
Slate* 12 x 12 1/4 or 3/8in	C$8+
Quarry Tile 12 x 12in	C$7+
Vinyls	
Fibre-reinforced tile 1/4in gauge	C$1.10 - 1.30
Continuous sheet welded seams	C$2.00 - 2.80
Non-slip, safety-grit	C$5.00 - 6.00

Rubber	
Large profiled tiles (slabs) 18 x 18in or 36 x 36in	C$4.50
Carpet	
Polypropylene	C$1.35
28oz 100% nylon (Fed.Gov.Spec.)	C$1.75
Carpet tiles	C$3.70

* dependent upon quality and uniformity, and hence wastage factor. Note one drawback of stone versus ceramic tile is the necessity of trimming by sawing.

(Sources: Del Tile Ltd; Baker Flooring Contracts Ltd.)

Cladding, Wall Tile and Other Architectural Components

The range of competing materials for wall surfaces in "prestige" applications in some respects parallels the range of hard flooring materials. Ceramic tile is used in great variety both indoors and out. Marble and granite are the predominant natural stone products in these applications whereas slate is a minor contender. Agglomerated stone tiles and glass blocks are also used in both indoor and outdoor applications.

Precast concrete is however, a vastly more common cladding materials. It featured strongly in the architecture of the 1980's, associated particularly with strongly geometric design in commercial buildings. The material fell from favour as styles changed and as problems associated with its use, such as uniformity of quality and discoloration from various sources, became recognized.

Today, developments in the composition and reinforcement of concrete and new methods of installation have expanded its range of use. Its ability to form large spans

is an important factor in the cost of installation. The capability it affords to replicate natural stones leads also to its use in association with them, or as an economical substitute.[1] In Newfoundland the use of precast concrete, (as well as brick and slate) is encouraged in the construction of public buildings since they are all materials which originate within the Province. Concrete masonry products are common as veneers both in commercial and residential construction. These materials, some with interlocking features, are also produced for such landscaping applications such as retaining walls and planter assemblies.

Natural stones such as sandstone and granite are used - as is slate - to produce shaped landscaping and interior components such as curbs, copings, gutters and stair treads. These same products are produced in the form of precast concrete and artificial stone at the lower priced end of the market.

A host of sheet materials also compete for the exterior prestige cladding market. Some are produced in single sheet (or slab) and insulated double skin forms. Examples are: fused, crystallized glass; stainless steel; aluminum in anodized, porcelain and other coated finishes; glass fibre reinforced plastic (FRP) profiled sheet; and exterior boards faced with natural stone aggregate bonded to FRP or cement-based panels. The choice of material and of system from amongst such a range of available products is therefore a

complex one in which the primary criteria of architectural treatment are set against the considerations of installed cost and maintenance requirements.

Some comparative average installed costs are as follows:

(Newfoundland)

Pre-cast concrete spandrels	C$30/sq ft
Brick veneer	C$12/sq ft
FRP bonded aggregate panels	C$ 7/sq ft

(Source: Beaton Sheppard & Associates Ltd.)

Roofing

Of all the markets for slate, roofing is perhaps the market which is the most differentiated by country, by virtue of the very different traditions of domestic residential construction in each. In Europe and certain previous colonies, where masonry load bearing walls were the norm, slate and other mineral materials with a relatively high ratio of weight to area were - and still are - viable contenders for a major part of the market. However, in the traditional roofing tile market, slate along with other local materials such as clay, has been subject to a long-term downward trend. Concrete technology allowed the development of much cheaper concrete and fibre cement tiles and labour with the required installation skills became scarcer and more costly. The use of asbestos fibre-cement tiles was adversely affected in the 1980's by the reaction against the use of asbestos and this encouraged the revival of the slate roof in the UK and the rest of Europe.

It spurred the development of asbestos-free, more realistically simulated synthetic slates.

In North America and British Commonwealth countries where frame house construction has been adopted in the twentieth century, light-weight roofing materials are necessary. Mineral tiles for residences are confined to specialty applications - generally high-priced individual dwellings. Asphalt shingle, for example, is overwhelmingly preferred for roofing in the US and Canada; other materials such as corrugated steel are common elsewhere.

Competitive products in the prestige residential market on both sides of the Atlantic are many. They include:

- metal interlocking tiles of copper, aluminum or steel coated with fused resin or with bonded mineral aggregate coating;
- shingles of aluminum, and of fire-proofed cedar;
- sheet metal, embossed to simulate tile or shingle;
- raised seam copper or other metal sheeting;
- clay tile;
- simulated slates of pigmented, fibre-reinforced cement (non-asbestos);
- simulated slates of resin bonded slate powder.

In general, the installed cost of slate roofing is higher than most of these competitive materials.

Some comparative average installed costs projected for US locations in 1988 are as follows: (Source: Building Construction Cost Data 1987).

Installed cost per square (100sq ft) including sub-contractors overhead and profit.

Black slate (VA, PA)	US$ 435 - 510
Sami weathering green/grey (VT)	US$ 445
Black/Grey (VT)	US$ 520
Green (VT)	US$ 555
Variegated purple (VT)	US$ 555
Purple	US$ 620
Red	US$1575

(Quoted costs vary little with thickness)

Mineral fibre shingles	US$ 145 - 345
Asphalt shingles	US$ 77
Ditto, heavy with rough texture	US$ 160

UK prices quoted for various tiles, man-made slates and slates are as follows: (Mid-1987. Prices are per square metre of coverage, FOB supplier, installation extra).

Clay Roofing tiles 10½ x 6½in	£14
Concrete roofing tiles* 10½ x 6½in	£10
Slate filled man made 300 x 335mm	£10 - 11

*Prices vary widely according to type.

For comparison:

Slate, best Welsh 24 x 12in x 5-6mm	£18 - 20
Slate, Spanish 24 x 12in	£ 7 - 10
Slate, artificial, fibre cement	£ 7

(Source: J. H. Rylance, Ltd.)

Newfoundland comparisons (supplied and installed)

Slate, artificial, US mfr.	C$1400 - 1700
Slate, natural, VT	C$1300 - 1700
Copper	C$1400

(Source: G. Lono)

The various discounts available are not applied to the above quotations.

In the non-residential building markets, in European countries (including the UK), the period of austerity after 1939 also encouraged the speedy construction of buildings with flat or low-pitched roofs. Subsequently, as the modern international style of architecture evolved in the post war decades, along with the corresponding construction techniques, the trend towards the use of flat roofs in commercial buildings continued world wide.

Today, the Post-Modern vogue and an emphasis on restoration and related building development have together influenced the architectural treatment of roofs in commercial as well as residential, building. However, slate and other tiled, roofs in non-residential developments are restricted to low-rise buildings which have some prestige element for commercial purposes and to the refurbishment of historic buildings or their surrounds. The commercial market is served by asphalt-based flat roof covering techniques by many welded-in-place membrane techniques; by profiled rigid sheet in metal and fibre cement; by raised seam metal sheet and by various twin skin insulated products.

Some comparative price data are shown below.
(Newfoundland)

	Supplied & Installed
Built up roof, tar & gravel*	C$3 - 4.50
Single-ply membrane system	C$6 - 7
Modified between system	C$11 - 12

*depending on type of felt

Summary

Slate in the 1980's is emerging from its historic downward trend as a utilitarian material overtaken by man-made products, to inhabit a niche at the higher priced end of the construction market. Positioned in this way, the relative appeal of slate will continue to be determined by trends in architectural fashion (including the trend to conserve traditional appearances), by marketing efforts and by promotion of the physical and mechanical properties of the stone itself.

Crushed, Powdered and Other Non-dimension Slate

The ratio of waste rock (excluding overburden) to the production of saleable dimension slate is generally reported as about 95/5. It presents a major disposal problem and there is considerable incentive to find ways to add value to it and realize some return on saleable by-products. Surprisingly, US producers have been shown little inclination to develop markets for higher value products but European companies have been more active in in this area.

Light-weight Aggregate

Slate, like shale and various clays, is used to produce light weight aggregate for concrete blocks and poured concrete. The industry statistics do not distinguish between the various raw materials. US production as expanded aggregate from these materials has grown from 3.7 million cubic

yards in 1982 to 5.5 million in 1986.[2] In Canada, production was about 200,000 cubic metres in 1985, of which 80 per cent went towards concrete block manufacture.[3] Production in 1986 was reported to be lower. Unit values in the US are in the US$20-30/ST range, depending on the distance from the plant. Carolina Stalite in North Carolina and the Solite Corporation are examples of major US producers. In Solite's case, the company's first plant was built close to a slate supply and operates with slate as the raw material. The rest operate on shale and clay.

In practice there is no technical preference for slate as a raw material and plants operate on the basis of the closest suitable raw material deposit. There is some suggestion that the absorption figures for concrete derived from expanded slate are lower than for concrete from shale or slate.[4] Other manufacturing variables affect product properties to a greater extent. Not all slates will expand satisfactorily. Minimum pyrite and alumina contents are necessary and testing is done routinely for these components and for silica.[5] Specific deposits of stone to be developed are checked for their ability to expand or "bloat", and equipment manufacturers will undertake this work in pilot plant facilities.

Production of light-weight aggregate in Canada is limited. Plant sites in the Toronto and Montreal areas have been shut down in recent years as they have been overtaken by urban spread. The only plant in Eastern Canada, in

Moncton N.B., operates sporadically to advance orders only. Fuel costs are a determining factor in the competitiveness of fired products of this type, so that future prospects depend somewhat on the relative price of oil. Fly ash from coal-fired utilities is an effective competitive material for expanded clay/shale/slate aggregate and is used extensively, for example in the UK where expanded slate production ceased some years ago.

Where physical properties related to weight of structure are important, lightweight aggregates come into their own. The offshore concrete structure is the prime example close to home. The Canadian Centre for Mineral and Energy Technology (CANMET) of the Federal Department of Energy, Mines and Resources has evaluated Moncton, Solite and Leopar materials from Germany for the physical properties of the aggregate and of the prepared concretes. Long-term performance data are essential for critical applications, and the above materials have adequate histories.[6] A new source of raw material, such as Newfoundland slate waste, would have to be subjected to similar testing over, for example, a three year period.

Roofing Granules

Roofing granules are particles of inert opaque material designed is to absorb radiation from sunlight which would otherwise degrade the asphaltic binder in roofing shingles and papers and render them brittle. The most important property is opacity. Roofing granule should also be free of

sulphides to prevent iron staining of the roof in service.

In the past, raw materials for roofing granules were chosen for their colour. This is still a factor which may favour the use of coloured slates. Penrhyn Slate Quarries Ltd., for example, developed both domestic and European markets for green roofing granules, and quarried a specific body of green slate to be crushed for the purpose.[7] However it is common practice in North America to add pigment to light-colored granular materials as desired or alternatively to fire a ceramic coating onto the granule surface.

In the US and Canada, the use of rock with an equi-dimensional fracture is preferred as a raw material for roofing granules. This avoids variation in the appearance of the roof when the light angle and viewpoint change. Such variations arise from the use of plate-like particles, such as slate, which take on a preferred orientation when incorporated into the shingle.[8] US slate producers have been able to elicit little interest in the supply of slate for roofing granules in recent years.

Total Canadian production of roofing granules in 1984 was about 300,000 tonnes, at an average value of C$70/tonne.[9]

In Europe, granules are also applied to roofing felts and papers, and slate powders, to underfelts for roofing.

In the production and trade statistics the respective quantities of granules and powders are not identified; indeed they are often not distinguished from waste slate in

general. Considerable quantities of both type of products are sold in Europe. Examples of UK production are: Penrhyn Quarries, up to 50,000 tonnes per annum;[10] and other quarries, such as Delabole Quarries around 10,000 tonnes. West Germany, France, Norway and Sweden, as well as Spain produce these crushed and ground products. Total volumes are obscured by the large figures for raw waste slate, but the estimated total European production is 200 - 300,000 tonnes per annum. The price range is around C$50 - 70/tonne.

Slate Powders

Slate powders are ground to several degrees of fineness for use as fillers in paints, rubber, plastics and asphaltic coatings and sealers.

The powders are said to retain slate's flake-like particle structure.[11,12] There are some potential functional advantages in the use of a filler of this type - particularly in covering power and possibly in the flow properties of the filled fluid during the process of application or manufacture depending upon the process in question. However, one Canadian producer noted that in the manufacture of roofing shingles, calcium carbonate normally gives better flow behaviour than does slate, and at higher loading levels[13].

The use of low value products such as mineral fillers is cost-sensitive. Properties are quickly traded off against the price of substitutes such as limestone and talc, and transportation distance is a decisive factor. One small

US quarry in California produces powdered slate only, which is sold for use as filler in asphalt slurry coatings for road and driveway repair. Price is in the US$50/ST range. US producers state that slate powders are relatively difficult products to handle and must be kept dry in storage and transit.

Two Canadian manufacturers of mineral fillers are listed in the Canadian Tax Index as dealing in slate powders. Neither has dealt with the product since the early 1970's.

A specialty application for slate powders which has developed during the last few years is the production of man-made roofing slates. These are composites with acrylic or polyester resins as binders, which are aimed at the higher priced end of the man-made slate market. The use of slate powder, rather than other fillers, is said to confer very good combinations of flexural strength, accuracy of colour and colour stability to the product. Redland and Britslate in the UK are two companies which have introduced such tiles to the market in the last two years. Companies in several other countries have developed, or have attempted to develop, similar products using slate powder, for roofing tiles, roofing sheet and building boards.[14]

The UK man-made slates of this type are intended to reproduce as closely as possible the appearance of natural slate. Slate as filler in in these products is not only important for the appearance it imparts but is also preferred for its combination of inertness, low water

absorption, and for the flexural strength that is obtainable in the product for a given loading of filler. The particle size distribution is said to be critical in this respect.

There has been interest in the UK in coloured slate powders and testing has been done on several, from various sources around the world.

The price paid for specific powder products may well exceed the general range quoted above. One respondent quoted a ceiling of about C$200/tonne.

As products such as these tiles become more highly developed, further critical evaluation can be expected of factors whereby powder quality affects performance in manufacture and in service. Premium prices may well be attached to more rigorous specifications.

Low-value Paving & Building Stone

In areas where construction sites are close to slate quarries, several types of by-product stone are sold. Squared building stone, "hedging stone", and crazy paving are sold FOB quarry at prices from 5 to 15 per cent of major product prices[15] [16]. Crazy paving constituted an export market from the UK to Scandinavia and West Germany for a period[17] and US producers have been able to sell sawn slate bricks as veneer for the housing market[18].

Construction Fill

At the low value end of the scale, slate is used as construction fill, in competition with other stone in the slate quarry area and at corresponding prices.

Research and Development

In the UK, Penrhyn Slate Quarries are said to be working on improvements in the performance of slate waste in artificial roof tiles. As large suppliers of slate powders, they also furnish technical information concerning powder applications. The Redland Roof Tiles Ltd. slate filled resin tile was launched in 1985 after considerable development effort. Britslate Ltd.'s product followed shortly afterwards. Weathering, at least with respect to colour stability, is said to be a concern with these slates.

The use of slate in these tiles, rather than some other filler, was apparently dictated mainly by the ability to produce an exact colour match with the corresponding natural slates. However, one company claimed that, in addition, slate filler imparted the most advantageous combination of strength, absorption characteristics and inertness to atmosphere.

Ongoing research is concerned with improved colour stability and, to some extent with the evaluation of other sources and colours of slate for behaviour in grinding and in processing into tile.

Since these slates are made specifically to simulate natural slates, there is little incentive to produce colours that belong only to a minority market. Nevertheless some evaluations of slates other than Welsh grey, heather and Lake District green have been performed.

The efforts made by the industry to solve problems and improve performance in the dimension stone industry at large should also be classified as R & D. Examples in the trade press deal with:

- Sealing components for low maintenance of stone;
- Sawing and shaping methods and equipment; computerized control and automated material handling. Similarly techniques for sanding, honing and flame finishing;
- Quarrying methods and equipment including the sawing and splitting techniques used on the stone after extraction, aimed at improving yields labour productivity, slab size and (perhaps) absence of strain in the stone.

[1]Progressive Architecture, March, 1987, pp. 114-119

[2]H. Robinson, personal communications

[3]Mineral Aggregates, D Stonehouse, Energy Mines & Resources Canada, 1986.

[4]H. Robinson, personal communications.

[5]E. Martin, personal communication

[6]A Comparative Study of Lightweight Aggregates in Structural Concrete. H S Wilson, Energy, Mines and Resources Canada Report #79-10. March 1979.

[7]Industrial Minerals, January 1971, p.39

[8]Industrial Minerals, October 1979, p.49

[9]Mineral Aggregates, Stonehouse, Energy, Mines and Resources Canada, 1986.

[10]Industrial Minerals, May 1986, p.31-32

[11]Industrial Minerals, october 1979, p.49

[12]R. Guillet, personal communication

[13]B. Setchell. Private communication

[14]Industrial Minerals, October 1979, p.50

[15]B. Setchell. Private communication

[16]Industrial Minerals, October 1979, p.50.

[17]Ibid.

[18](Still to find reference)

MARKETS

Overview

This Chapter comprises the trade and market data collected during the survey concerning individual countries which are significantly involved in the slate trade. The US and Canadian markets, as those of most immediate importance to the production of slate in Newfoundland, are examined first.

The countries of Western Europe, the traditional users of slate, are introduced by a fairly detailed treatment of the UK and Eire because of past trading patterns and geographical proximity. Sections on France (a major user) and Spain (the major producer and exporter) follow, with subsequent coverage of other European countries which use slate.

Australia is a significant user in the Pacific, with recently increased consumption. India is a minor exporter and China a recent entrant. Much of Hong Kong's slate imports originate in China, which led to treatment of these two countries together. Very small quantities are imported by Japan.

Slate is exported in significant quantities by South Africa and deposits also exist in South America.

In the USSR and Eastern Bloc countries, at least Yugoslavia and Poland have mined slate in the past but no

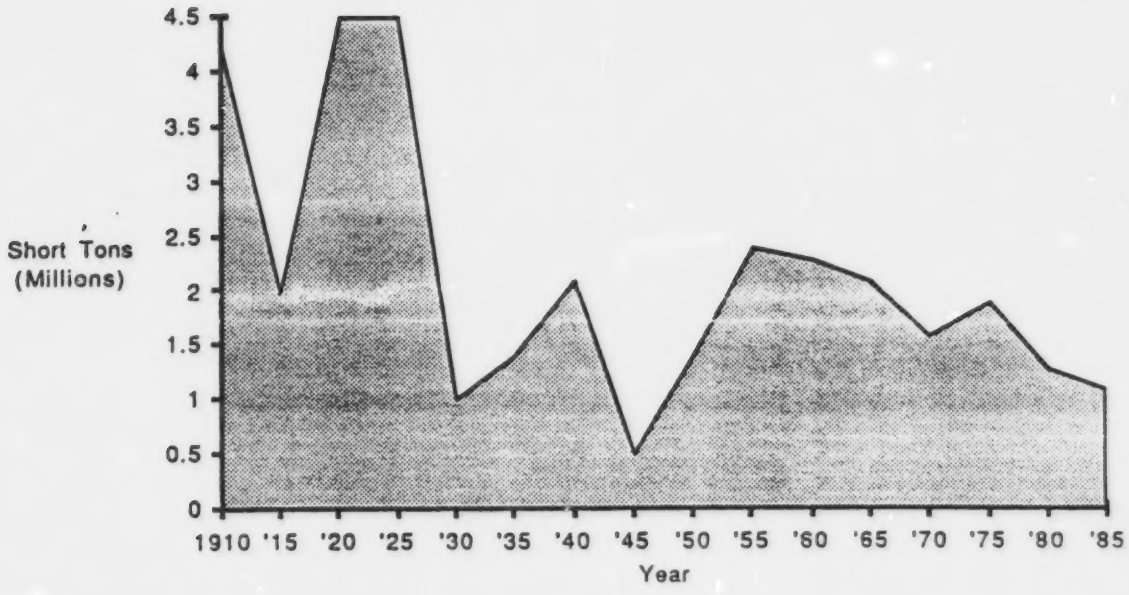
evidence of trading or of significant usage was indicated by the Canadian Trade Posts or relevant government figures.

United States

Overview

The overall annual value of all dimension stone sold in the US is in the 500 million dollar[1] range. Of this, some 60 per cent is imported. The broad historical representation of US production below shows the effects of the two world wars and the Depression, and places the current levels of production in perspective.

DIAGRAM 1
US Domestic Production, All Dimension Stone
(millions of short tons)



The nature of the industry has changed with the development of techniques which increasingly allowed stone

to be prepared in thin slabs and used in building facings and other architecturally-related applications. More recently, dimension stone sales grew at 10 per cent per year from 1980 to 1985 and almost 30 per cent in 1984.[2] Estimates[3] for 1986 and early 1987[4] figures show something like a 15 to 20 per cent rate of growth continuing.

This growth was contributed by imports, 90 per cent of it by marble and travertine. Granite volumes showed little increase but slate and limestone (in minor proportions) have also shared in the rapid increase in dimension stone imports.

In 1985 and 1986 the value of slate imports grew by 25 to 30 per cent per year. Domestic production of slate had a modest growth rate of 10 per cent or so per year during the same period though less than that in terms of tonnage. Imports accounted for around 35 per cent of slate sales in the US in 1983-84 and reached 40 percent in 1986.

Consumption

Slate in the United States is a 30 to 40 million dollar business. The US government production and trade statistics indicate that the market consumes between 50 and 60 thousand tons of dimension slate per year (Table 4) though these figures appear high to industry people in the US. The precision of the statistics available allows only a general representation of trends. With the 1986 figures not yet available from the Bureau of Mines, the current

growth rate is based upon estimates only which suggest that consumption rate is presently growing at 10 per cent per annum.

Table 4: Approximate Usage of Slate, US
(thousands of short tons)

	1986	1985	1984[1]	1983	1982	1981*	1980*
Domestic Production	n/a	41	39	50	41	119	90
Imports **	23	18	14	8	12	26	18
Total***	n/a	59	53	58	53	145	108

Source: Us Bureau of Mines Yearbook

Notes: * USBM notes that pre 1982 statistics for slate are high and should be revised downwards to remove the 1981/82 discontinuity.
**Average customs values for all products in all years are taken as US$420/ST in order to arrive at rough tonnages. (Appendix R).
***No allowance for exports or inventory changes
[1]Private communication

Most commentators agree that, as in other parts of the world, the consumption of slate (along with other dimension stone in the US) is affected by the reaction of many architects away from concrete, and away from the glass, steel and enamelled curtain wall of the sixties commercial building. The trend has been towards a style of architecture which incorporates natural textures and colours on both exterior and interior walls; in the treatment of flooring, paving and other surfaces of interiors; and in the surrounding cityscape and landscape architecture. This movement has been encouraged by continuing developments in the economic production of thinner slabs and by improvements in fixing techniques for dimension stone.

A parallel trend shows up in the choice of a traditional look in the design of roofs. Pitched roofs and simulated mansard roofs are increasingly used in developments in townhouses, condominiums and low-rise commercial centres and office development.

A second major factor is the influence which government departments and conservation bodies bring to bear on the choice of materials in public buildings and "heritage" projects. Buildings dating from the past two centuries in cities and towns of the eastern United States are now the subject of preservation of (and/or restoration) to their original form, for reasons of tourist attraction if not for civic pride and a concern with tradition. This movement is not restricted to government initiative; property developers in such areas also react to the trend which developed in the late 1970's and 1980's for the "heritage" look in high priced downtown residential and office space.

It is difficult to discern the extent to which these different influences are directly affecting specific uses for slate. Architects differ in their assessments according to their individual preferences, and slate is just one material among many which satisfy current trends. Nevertheless, the production and import statistics show that this relatively small market has been growing $2 million to $4million annually since 1983 (Table 5).

Our interviews with of members the industry confirm that in both the expensive residential markets and the low-rise commercial office market, slate roofing has been in good demand and various producers have reported increases in sales of flooring slate in boxed form and for both high-priced home and speculative building contracts.

Table 5: Dimension Slate Production & Imports, US
(millions of current US dollars)

	1985		1984		1983		1982		1981		1980	
	Dom	Imp	Dom	Imp	Dom	Imp	Dom	Imp	Dom	Imp	Dom	Imp
Roofing	6.3	0.9	6.1	0.6	4.3	0.1	3.6	0.1	2.9	0.1	3.5	0
Structural	3.1		2.7		1.8		1.7		3.9		3.4	
Flooring	2.4		2.4		3.3		2.9		9.5		5.3	
Flagging	1.8		1.6		2.1		1.9		2.7		1.9	
Non-roofing (not specified)	-	6.7	-	5.2	-	3.4	0.1	4.8	0.5	10.7	0.6	7.5
Total	13.6	7.6	12.8	5.8	11.5	3.5	10.2	4.9	19.5	10.8	14.7	7.5

Sources: USBM yearbooks and US Dept of Commerce Trade Statistics

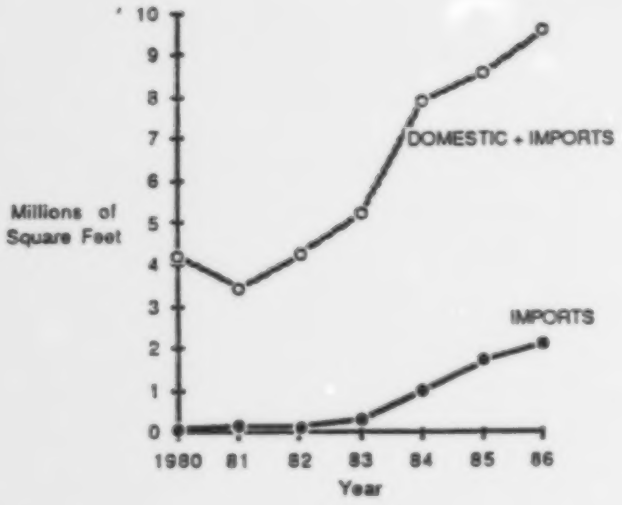
Notes: Imp: Imports at customs valuation
Dom: "Sold or used by US producers" (USBM Yearbook)
1986 Imports: roofing $0.93M; other $8.87M

Roofing: Consumption of roofing slate in the United States has almost tripled since 1981. The value of roofing slate sold, or used internally by producing companies in 1985 was $6.3 million dollars. Imports totalled $0.9 million, (up from an annual level of about $100,000 in the years 1980 to 1983). The total United States roofing market in 1985 was therefore about $7.2 million, representing roughly 8 to 10 million square feet. (plane measure as opposed to laid measure, or coverage)

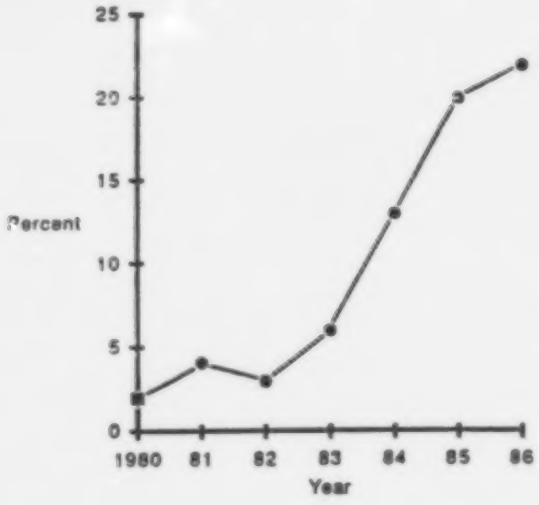
DIAGRAM 2

US Production and Imports of Roofing Slate

A. ROOFING SLATE: UNITED STATES
Domestic Production and Imports



B. ROOFING SLATE: UNITED STATES
Imports as % of Sales



Non-roofing Slate:

Flooring and Structural: Producers note that US flooring slate production in 1986 increased to meet a general growth in demand. A clear picture of this market is difficult to obtain from the statistics. Although the Bureau of Mines data are apparently consistent from 1982 onwards, the years 1981 and earlier contain large numbers for flooring which are difficult to interpret and should probably be revised downwards to show a relatively much smoother trend.[6] Data for still earlier years seem to reflect changes in nomenclature, according to whether paving material in general is classified as flooring or flagging. On the other hand, comments from the trade indicate that boxed 12 x 12in floor tiles are currently being produced in much higher volumes than statistics indicate and that the US government production figures for flooring slate might be low by as much as a factor of 2.

The import statistics blur the matter further, since non-roofing dimension slate enters within a single classification, and customs value is recorded without corresponding tonnage.

Broadly, however, imports of non-roofing slate have been rising since 1983 and have regained the levels recorded for the early 1980's. Italian slate maintains a steady 55-60 per cent share of these imports. In order to arrive at estimated values for the annual imports of

flooring and structural slate it has been assumed that 80 per cent of Italian imports are assumed to be billiard table slate. The remaining import values should then approximate to the flooring and structural slate entering the US (Table 6). These figures represent an estimated 40 per cent of the combined flooring and structural market in dollar terms.

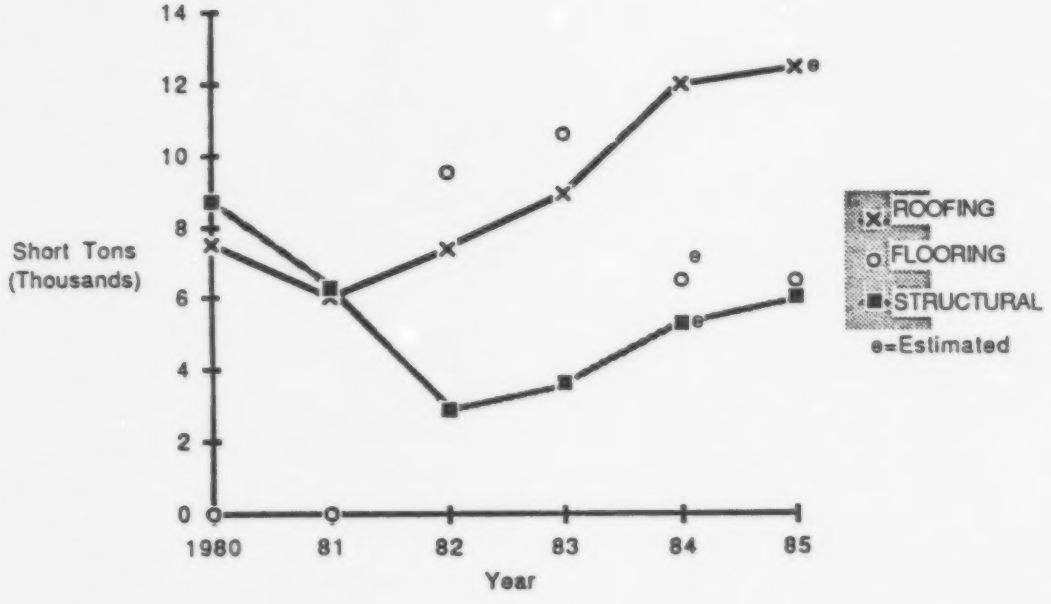
Billiard Table Slate: This market is almost wholly supplied by Italian producers, the small share retained by Pennsylvania producers being included with structural slate in current USBM statistics.

Table 6: US Flooring & Structural Slate, Domestic and Imports (millions of current US dollars)

	Domestic Flooring & Structural	Imports Customs Value Non-roofing Est'd Flooring & Structural	Total
1982	4.6	2.0	6.6
1983	5.1	2.4	7.5
1984	5.1	2.2	7.3
1985	5.5	3.6	9.1
1986	n/a	4.5	n/a

cf. Appendix R 2.1
Source: USBM Yearbooks and US Department of Commerce Trade Data

DIAGRAM 3
Domestic Slate Production, US (by type)



Sources of Supply

Domestic: 19 companies produced slate in the US in 1985[1] (see Appendix J)compared with about 35 in the mid-seventies. Since then there has been some consolidation of the Virginia companies and the numbers of active Vermont producers fluctuate somewhat from year to year.

The larger quarries perform dimensioning and finishing operations on the stone produced and thereby serve as suppliers to larger contracts as well as suppliers to masonry processors and dealers. Roofing slates are produced directly by the quarries or in some instances, by their gathering agent.

The historical patterns of growth and contraction in slate production shown by the Bureau of Mines statistics are complex and appear to contain anomalies during certain periods. These statistics do, however, show a consistent increase in both roofing and structural slate production since the early 1980's. Both roughly doubled by 1985, following the low points they reached in 1981 and 1982 and thereby recovered to the higher levels recorded prior to 1980.

Dimensioned flooring figures show a decline in the same period after some wildly high figures in 1980-81. Unfortunately statistics for 1986 which should clarify the trend are not yet available.

These data, though originating from the industry, are at variance with some comments from the trade in the US

which refer to much higher outputs of regular 1/4in 12 x 12in gauged floor tile by the smaller low-cost producers.

These operations are flexible, and as roofing demand rises, production can be expected to shift accordingly. The following rough estimates of product types and volumes by origin (other than flagging) reflect a higher estimate for flooring slate productions than do the USBM figures.

Table 7: Approximate Distribution of US Dimension Slate Production
(per cent)

	Roofing	Flooring	Structural	Total
Vermont-New York greens, greys, purple	30	20	7	57
Pennyslvania-Virginia; blue-black, grey; large slabs	15	7	18	40
Others, California, Arizona; blacks, multicoloured	-	3	-	3
TOTAL	42	28	25	100

Imports

Whereas most of the recent increase in domestic production took place during the period 1982 to 1984, the current marked import growth began only in 1984 and has been steady since. Imports appear to be heading for 50 per cent of total consumption in 1987. (Table 5 and Diagram 4).

Imports to the US have traditionally been led by

Italy. Italian imports increased markedly in 1986, thus maintaining this leading position during the current period of rapid overall growth. However, Italy's virtual dominance of the US trade prior to 1983 has been eroded by the expanding variety of new imports from many countries. Italian slate accounted for about 60 per cent of imports in 1984, dropping to around 50 per cent in 1985 and 1986. It serves principally the billiard table, indoor flooring and fireplace facing markets in colours predominantly black and green. A significant and rising proportion of imported roofing slate also originates in Italy.

Slate imports from the UK scarcely showed in the statistics of 1980-81 for flooring/paving/architectural uses. There has been a more or less steady growth since then. 1985 and 1986 import statistics show a total customs value of $1.6 to $1.8 million. The UK was therefore the second largest importer to the US in those years.

UK roofing slate imports began to be appreciable in 1985, when they accounted for 60 per cent of the import surge just beginning at that time. However, the trend has been downward since, as UK slate has been supplanted by cheaper products from China and Spain.

Diagram 4
US Slate Imports
(millions of current US dollars)

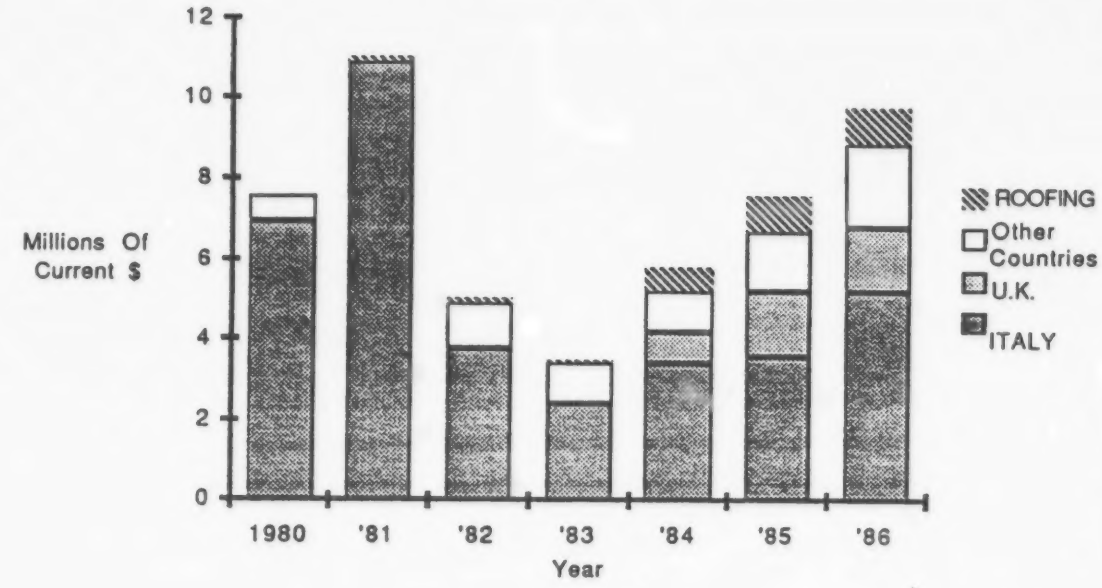
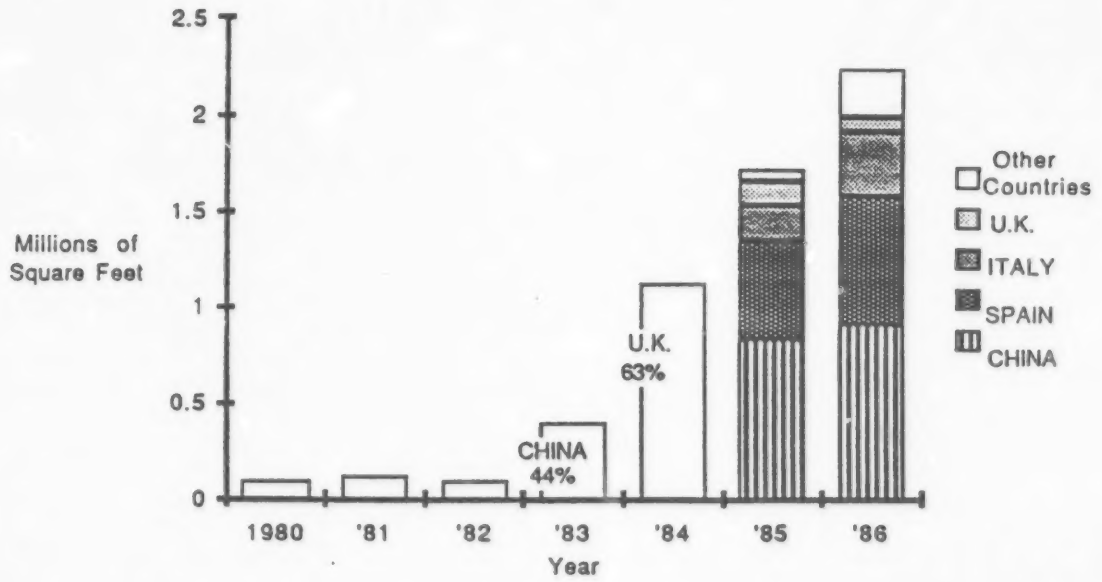


Diagram 5
US Roofing Slate Imports
(millions of square feet)



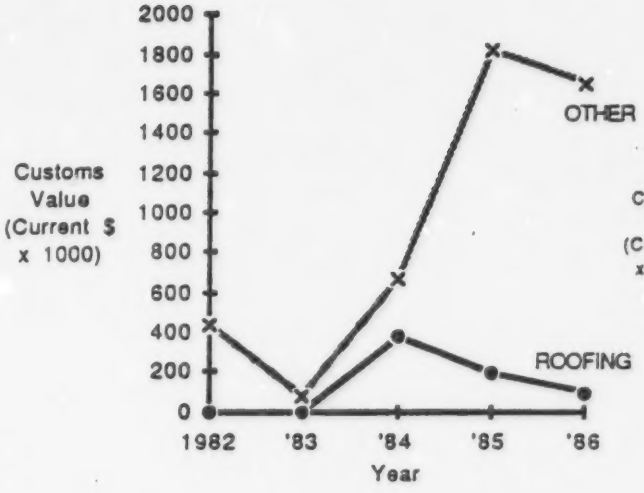
Spanish slate has been a major component of imports throughout the 1980's. However, whereas roofing slate was only a small proportion of Spanish imports in the early years, quantities have risen dramatically since 1985 and slate imported for other end-uses has concurrently decreased. (Diagram 6).

China has become the largest single outside source of roofing slate to the US and in 1986 accounted for almost half the imported square footage. In the same time period - roughly since 1985 - imports of non-roofing slate from China, though small in absolute terms, have also increased rapidly. (Diagram 6).

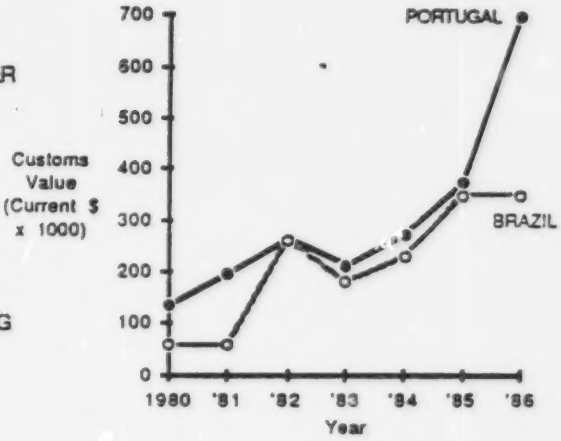
Portugal has been a steady supplier of the US market in the mid 1980s and its volume of exports to the US roughly doubled during the period 1985 to 1986 (Diagram 6). The proliferation of imports into the US is tabulated in more detail in Appendices R and S.

Diagram 6
US Customs Values
(thousands of current US dollars)
Slate Imports

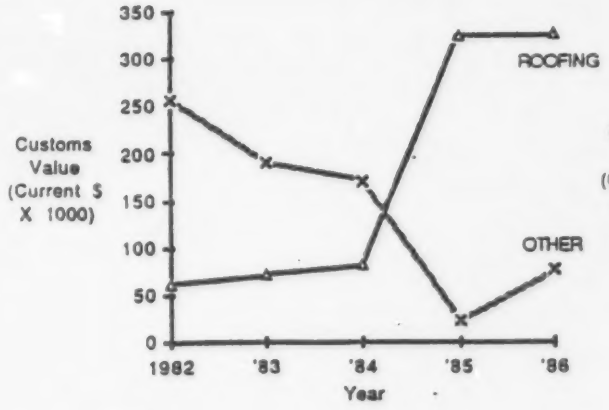
A. Slate imports from the UK



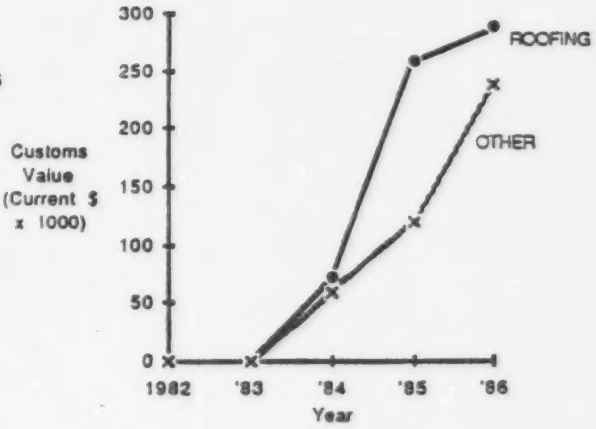
B. Slate imports from Portugal and Brazil



C. Slate imports from Spain



D. Slate imports from China



An interesting light is shed on the import trade by some statistics from the Port of Los Angeles where slate imports into Californian ports during the 18 month period February 1986 to July 1987 were approximately 11,000 tonnes. Of this total, the product types were identified as follows:

Table 8: Slate Shipments into the Port of Los Angeles 02/86 to 07/87

	Tonnes
Roofing	1,100
Flooring	400
Rough, including paving	500
Slabs	3,800
Slate, not further identified	5,005
TOTAL	10,800

Source: Port of Los Angeles Statistics. Special Search

Note: Waste, flakes and powder not included.

Although subject to errors from misclassification for customs, the port statistics demonstrate the variety of products entering the US. The countries of origin and examples are given in Appendix 5.

Exports

The US exports principally non-roofing slate in small quantities to an array of countries (Appendix T). Total shipments in 1986 were valued at about $1 million. 30 per cent went to Canada, 15 per cent to Saudi Arabia and the balance, to 30 or more other countries in quantities valued at $2,000 to $60,000.

TABLE 9: US Exports of Dimension Slate
(thousands of current US dollars)

	1986	1985	1984	1983	1982	1981
Roofing	118	133	177	385	133	287
Other	967	1,568	960	967	1,501	1,993

Sources: USBM yearbook in 1985
US Department of Commerce, Trade Statistics

Product and Market Characteristics

Roofing: The US market for slate is very competitive. Buyers are impatient and typically want exact adherence to a specified mix of colour and dimensions. There are enough producers, in the Vermont/New York area at least, to keep competition stringent. The expanded import level reinforces the situation. The largest single market segment in the US is roofing slate, installed increasingly on prestige residences on the one hand and on low-rise commercial buildings on the other. Banks, corporate office headquarters, and golf clubs are examples. Restoration projects

and urban renewal developments with a historical aspect have already been mentioned.

Roofing slates are sold for the most part in standard lengths but random widths and in thicknesses from 3 to 7mm. European imports are thin; US production is normally 3/16 to 1/4in (4.7 to 6.4mm) and the small amounts of green British slate imports are 7mm thick and up.

Although the larger sizes of slate are in demand (see Appendix V) and in domestic production command a premium price, US quarries normally ship mixed sizes. Shortage of supply of the the larger sizes is often circumvented by the installation of courses of slates of graduated length. The same is commonly done with graduated thickness, at least in the UK.

Slates sold for roofing are principally blue-black, grey and green with blue-black from Pennsylvania and Virginia representing an estimated 30 per cent of the total domestic production. Vermont and New York producers account for the remainder. Imports from Spain and China are predominantly grey and black. These colours are further divided by the industry into semi-weathering and permanent (non-fading) colours and mottled mixtures of two colours such as grey/black and purple/green also occur.

The issue of inflammable roofing material has been of concern in California for many years. Fire regulations established in recent years in Southern California called for a standard of fire resistance which precluded the wide-

spread cedar shingle from use. Although the cedar shingle roof constituted a very small part of the market, numbers of substitutes were promoted. For example, concrete, aluminum, enamelled steel, clay tile and also slate were brought more aggressively to this market and demand for slate roofing rose. This trend coincided with both the rise in exporting activities by the Spanish roofing slate industry and with the advent of Chinese in the market. Eastern US producers also moved to take advantage of the development of this market, but faced the considerable disadvantages in transport costs which result from the requirement that waterborne shipments must be in US vessels.

The development of acceptable fire retardant cedar shingles at moderate cost resulted in a partial regain of market share and further recovery is expected. Nevertheless, this chain of events encouraged importing activity and local slate dealers expressed the opinion that slate roofing for higher priced homes will continue to occupy a niche in the California market. One representative of the trade assessed the value of the slate roofing market in California to be upwards of $1 million per year at present.

Architectural and Flooring: The architectural slate market can be divided into two segments. The first, for external facing components for major buildings, is a segment where installation cost considerations require large slabs

up to 2in thick. It is served principally by the Virginia producer(s) and by imports. Sales are commonly supported by the engineering design, draughting, and provision of fixing materials required for proper installation.

The Pennsylvania blue-grey slate presently in production is unusual in that it combines cleavage properties that leave a fine natural cleft surface with a high degree of machinability. The combination of properties makes it suitable for architectural use when not exposed to weather and allows very rapid, low cost production of floor tiles. For the same reasons, it was previously used for billiard table tops and in shaped electrical insulators.

Virginia grey-black slate and the Vermont slates, like the Pennsylvania slate previously produced near the Maryland border, are less easy to work and are less fine grained with a more pronounced, wrinkled cleft surface.

The second and larger segment of the architectural market comprises demand for the smaller wall cladding tiles or slabs for exterior and, more commonly, interior use. It often arises in conjunction with more extensive flooring and paving work in the same job. An entry concourse in an office building or hospital would be a typical example, in dimensions up to 24in square tiles for wall or in floor. There are some major examples in Texas, using Pennsylvania black slate; an IBM office complex in North Carolina, using red Vermont slate and various projects in California and elsewhere employing Burlington and Kirkstone green from the

UK (Appendix I).

Wall components are generally ungauged; interior floor tiles are commonly gauged and set on a sub floor and exterior paving is set in cement. Installation standards are strict. Thickness depends upon the other two dimensions. Commercial interior flooring installations typically are 3/8in at 12 x 12in and 16 x 16 and 1/2 in for larger sizes. Exterior paving is 1 to 1 1/2in and ungauged.

In addition to and overlapping the above flooring market, there is a major commodity floor tile segment composed mainly of 1/4in x 12 x 12in gauged tiles, sold both to building contractors and put up in boxes of 10 through building supply chains and stores. The trend is towards single-colour one-size packages and away from the previously popular pre-designed package of 10 sq ft which contained mixed colours and various sizes in multiples of 3in.

The variety of slate floor tile materials being imported to the US extends the domestically produced range considerably. Spanish slate is predominantly black with some green, but China exports black and a number of colours. South African slate comes in some unique colours, amongst them a silver-blue which is ready-gauged and very

"adequate" and some samples tested have been equivalent to Vermont slate.

Imported flooring materials are normally shipped cut to size, gauged and ungauged for both 1/4in and 3/8in finished tiles, but possibly, in some cases also as slabs for cutting stock.

On a smaller scale, there is an interesting segment of the market (totalling perhaps 1,000 to 1,500 tonnes per year) in unsawn flagstone for both interior and exterior flooring and paving in the Western US. Two quarries in California and Arizona are able to produce large slab sizes in black slate or black mottled with gold and various colours. Their markets are largely in the Western US though there have been some export orders.

There are said to be many regional preferences in the flooring slate market: Florida, for instance, taking more mixed colour packs; Detroit preferring installation in "mud"(cement) rather than thin-set and the West preferring Arizona black slate in irregular shapes.

Regional variation and trade reticence impedes estimation of the relative volumes of different colours sold in floor tiles. Black and red are generally the most expensive flooring tiles and black, at least in the Southwest, was said to be one of the less popular colours. While purple (including the variegated purple and green from Vermont) was said by one New York dealer to sell fairly well, a major California dealer who sells numerous colours from many

sources (including multicoloured slate from Italy) had never seen purple slate.

Prices

There are several measures which can be used to determine the order of magnitude of price pertaining in the US slate market. These include the price ranges quoted by producers and dealers in addition to the US Bureau of Mines and Dept of Commerce statistics.

The Bureau of Mines' annual compilation of producers' figures puts at least a nominal value on slate products at the quarry gate. (Table 10). These values are somewhat lower than estimates derived during the survey from discussions with representatives of the trade.

Table 10: Valuation of US Domestically Produced Slate
(current US$/short ton)

	1985	1982
Flagging	115	111
Roofing	507	482
Structural	510	582
Flooring	376	305

Source: USBM Yearbook

The values received from the evaluation of imports for customs show the following, using in this case 1986 for the most recent available figures (Table 11).

Table 11: Valuation of Roofing Slate Imports to the US 1986
(selected examples US 1986 $)

Origin	Customs Value $/sq ft[1]	C.I.F. $sq ft	C.I.F. Value $/Short ton[2]
UK	1.14	1.45	673
Spain	0.49	0.68	476
China	0.31	0.51	357
Italy	0.28	0.32	224
All Countries (av)	0.44	0.65	455

Source: US Dept of Commerce Trade Statistics.

[1]plane measure, not "laid measure"
[2]using the conversion 700 sq ft/ST for a nominal 5mm thick slate
[3]Using 470 sq ft/ST for a nominal 7.5mm slate.

Taking these figures at their face value puts the average landed value of all imported roofing slate, 8 per-cent duty paid, at about $490 per short ton. The prices of Chinese and Spanish roofing slate imports quoted by the industry for 1987 are upwards of $425 per short ton.

The import statistics for other types of slate are less helpful - or certainly less detailed, in that the price/quantity relationship is not so readily available and there is no distinction made between slates for flooring, other architectural uses, pool table tops, and so on. In the case of a major contract for building facings, we can assume that the landed prices of granites and the more expensive marbles, at $8 to $12 per square foot, represent a normal ceiling for competitive dimension stone building facings.

For domestic flooring slate we can compare the USBM yearbook figures with the price ranges, ex-quarry quoted by various producers and dealers.

For example:

. "We sell 1/4in, gauged one side, 12 x 12in tile for US$1.50 less 22 per cent discount for whole-sale customers." (quarry agent)

. "One region produces up to 8 million sq ft of 1/4 in 12 x 12in. It can be had in cartoned lots for as low as 85¢ and tile suitable for speculative building projects as low as 50¢. It is the cheapest hard flooring material available." (producer)

- "California unsawn slate flooring and paving is priced between $300 and $450 per ton, FOB quarry, the higher prices being for large slab size and for thickness less than 3/4in." (producer)
- "The cheapest white marble is $3.50 to $5.00 US and that puts a range on slate." (dealer)
- "We retail green 12 x 12in for $3.85 (US). These prices are less 40 per cent to dealers." (US West Coast dealer)
- "The lowest price at which we can get 1/4in 12 x 12in tile is $1.50 per square foot." (West Coast dealers)

The following rough progression of values and prices[7] in the US industry should therefore be representative.

in-quarry: value of rough slate	$200/ST
↓	
ex-quarry: ungauged tile value	$250 plus/ST
↓	
ex-quarry/plant sales gauged 12 x 12in	$0.50 to $1.50/sq ft
↓	- $280 to $840/sq ft
wholesale sales	$1.00 - $2.30/sq ft
↓	
retail	1.20 - $4.50/sq ft

Since the prices for major building development contracts reflect the specific tastes and demands of the architect, it can be assumed that the above wholesale prices represent base prices and a point of departure for large contract negotiations.

U.S. - Footnotes

[1] US$ are quoted throughout this section on the US as opposed to the Canadian $ standard throughout the bulk of the report.

[2] US Bureau of Mines Yearbook, 1985.

[3] Private Communications, H. Taylor Jnr.

[4] Ibid.

[5] US Bureau of Mines Yearbook, 1985.

[6] Private Communication, H. Taylor Jnr.

[7] Values and prices are in US$.

Canada

Overview

Although Canada is emerging as a significant contributor to the North American dimension stone industry, slate is barely a factor. Nevertheless the upward trend in the world-wide slate trade has encouraged the resumption of production in Newfoundland and also some preparatory rehabilitation of a quarry in the Province of Quebec based on a deposit of black slate. There is also some mention of production in northern British Columbia.

The slate business in Canada is largely conducted by three Ontario/Quebec floor-tile companies. Some 5 to 15 per cent of the business of these companies is in slate and the preponderance of their slate is for flooring. Slate roofing is almost entirely destined for refurbishing of historic properties and new buildings in adjoining areas.

Until 1986, Canadian demand was satisfied entiraly by imports. Small quantities of floor tile material are currently being supplied by the Newfoundland quarry.

Consumption

Estimated values of slate entering Canada for further processing or resale are largely based upon import figures which are subject to some doubt. However, a good order-

of-magnitude figure is $800,000 annually, which at an average value of $700 per ton for rough conversion purposes, equates to an annual volume of 1,100 to 1,200 tonnes per year.The statistics are not good enough to determine a trend with any certainty.

Sources

Domestic: At one time, the Quebec slate industry was bigger than that of the US.[1] The sole producing Canadian slate quarry at present is at Nut Cove in Trinity Bay, NF., about 200Km from the major port of St. John's. This quarry was in operation until 1906, and reactivated in 1985. The site is on tidewater with road access planned for 1988. Purple and green slate are currently produced and annual capacity is about 2,000 tonnes. A deposit of red slate is close by.

Production to date has consisted of roofing tiles, principally sold in the US, and ungauged floor tiles sold to Canadian processor/dealers. Small amounts of roofing and sawn paving have also been supplied to new building and restoration projects in Newfoundland.

The floor tile producers in Central Canada use ungauged sawn tiles (supplied by the Vermont/New York quarries) as their principal raw material. Cutting stock in large slabs is also used to a lesser extent, depending on price, quality and delivery. The lower duty (5.5 per cent) and price can

quickly be offset by wastage which varies from say 10 per cent to 50-60 per cent. Splitting characteristics are clearly very important and this can vary from point to point in a quarry and hence from shipment to shipment. As well as drastically affecting processing costs, the appearance of the cleft surface is also affected by the splitting behaviour of the slate.

Ready-gauged tiles are also imported for re-sale and this appears to be the preference of at least one of the Canadian dealers at present, again depending on price.

Imports

Broadly interpreting the data for 1983 and 1984 (Table 12) the US and Europe together ship about $900,000 worth of slate to Canada yearly (at customs valuation). Roofing slate now constitutes about 10 per cent of this total. Non-roofing imports fluctuate year by year, reflecting the varying effect of large commercial contracts on the consumption of floor tiles in any one year.

Table 12: Slate Imports to Canada
(thousands of current Canadian dollars)

A. Canadian Statistics

	1982			1983			1984		
	EEC	US	TOTAL	EEC	US	TOTAL	EEC	US	TOTAL
Roofing Slate	83	47	130	106	57	163	36	140	176
Other	544	287	831	345	99	444	232	89	321

B. US Export Statistics (Dept of Commerce)

	1981	1982	1983	1984	1985	1986
Roofing Slate	85	61	132	55	75*	81
Other**	1,570	700	420	650	730*	450

C. UK Export Statistics

	1984	1985	1986
Roofing Slate	0.4	0	20
Other	0	70	100

*USBM Yearbook
**Italy accounts for 70 to 90 percent of Canada's imports from the EEC.

Product Characteristics

Perhaps 60 per cent of the floor tile business is for installations in commercial and other public buildings and the larger part is for indoor flooring. A typical contract might be for an area of between 2,000 and 5,000 sq ft, increasingly in gauged tile, "thin-set" on a sub floor. Potential problems arising in outdoor installations, if water run-off is not properly designed, cause contractors not to seek this type of business.

The trend in both commercial and household markets is away from the mixed-colour, mixed size packs and towards monochromatic and one-size installations. Square tiles are strongly preferred and the 12 x 12in size is increasingly becoming a standard.

Demand for specific types of slate is a very erratic phenomenon. In a relatively small-volume business such as this, one major flooring job for which red (for instance) is required, makes a significant contribution to the year's figures.

However, green is the predominant colour for flooring except in Western Canada. This was supplied by the US until the recent exporting activity by Spain.

Grey and blue-black slates constitute the next largest volume colour preference, and imported grey slate can be obtained very cheaply. Spanish green slate shipments have been of poorer quality than Vermont green, and offered no

price advantage. Black slate from the US Southwest, generally unsawn, has set a minor fashion in the West where it is more easily available. Larger sizes tend to predominate in this market.

Red slate in good sizes and without green inclusion is in short supply, but at the same time not in strong demand. Purple is sold in minor quantities only.

The architectural slate business typically constitutes about 5 per cent of the total Canadian consumption and is variable depending upon major contracts. Instances of failures have made contractors nervous of stone facings.[2] The improvements in recent years in fixing methods for dimension stone in building facings will have a positive effect on the willingness of architects and engineers to consider the use of slate.

The English Lakes producers continue to obtain contracts in Canada for their particular type of stone, exemplified by the Bank of Commerce building in Montreal and more recently by the extension to the Bank of Canada head office in Ottawa. In the case of the Lake District product, polished stone currently outsells the natural cleft surface stone. Large architectural slabs from Pennsylvania are becoming progressively less available and more expensive. Virginia producers continue to be the US leaders in this area.

The Italian industry has a major advantage in the supply of large slabs, for example up to 6 x 6ft, with the reservation that outdoor use turns the black slate silver-

grey. Price and quality are both very competitive with Pennsylvania slate.

The pool table market, which is progressively moving to lower thicknesses, is supplied for the large part by Italian slate with increasing quantities of Portuguese material at the lower priced end of the market.

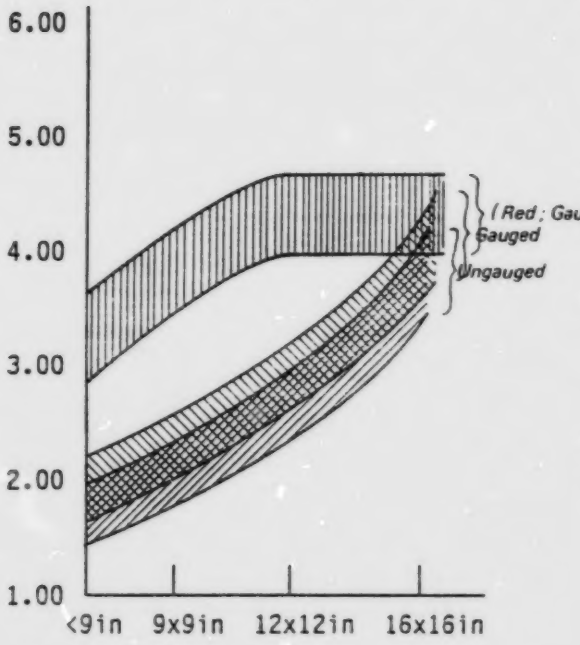
As with the slate industry elsewhere, technical product specifications are little used by Canadian processors. As an example, although hardness (as it affects gauging) is important to the processor, hardness figures are not demanded.

Price

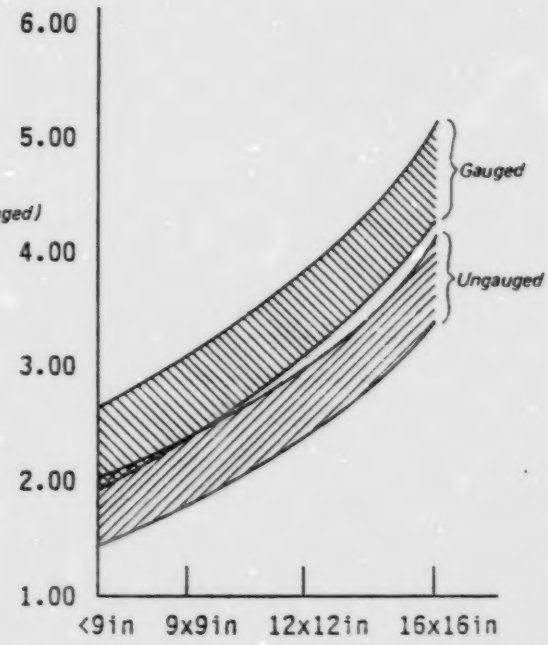
A series of typical price bands quoted by a Canadian slate floor tile supplier is presented in Diagram 7. It represents prices per square foot to the trade, FOB plant, before federal sales tax (see also Appendix Q). These prices should be compared with the chart of slate values on page 70[3].

DIAGRAM 7
Slate Floor Tile Price Approximations
1987 C$ per sq ft, FOB, Plant
Grey, Purple, Green; Gauged vs Ungauged

A. ¼ in thick



B. 3/8 in thick



Architectural components, such as stair treads and sills, gauged on the under side, priced on the same basis, are quoted per linear foot, in the region of $20/ft for 8-10in width and 2in thickness.

Indicative prices for roofing tile are quoted as $300 - 400 per square for unfading green and $200 - 300 for other colours.

Footnotes - Canada

[1]John Wright, Acme Slate and Tile Co, personal communication.

[2]Hamilton City Hall; galvanized anchors rusted (D. White).

[3]An Eastern US price, for 1/4in thick 12 x 12in gauged tile, of $1.40/sq ft plus duty of 9.9 per cent and transport costs of, say, $0.10/sq ft to Ontario, is equivalent to approximately $2.30.

United Kingdom

General

The UK market for slate is dominated today, as it has always been, by the demand for roofing slate; 85 per cent of domestic slate sales are for roofing. Growth since the early 1980's has been rapid, in part as a result of demand created by a reaction against the use of asbestos in roofing tiles, as in other products. There was at that time no convincing alternative to asbestos fibre cement artificial slates which simulated the appearance of a natural slate roof, though manufacturers adapted to the change in market conditions and strove to offer substitutes for asbestos cement slates - such as the resin based tile.

This positive effect on the roofing market was reinforced in the early and mid 1980's by a government grant program paying virtually the entire cost of re-roofing houses built before 1910 and which had originally been roofed with natural slates. Funds available under this program are now limited and it is not a major stimulus at present to the slate roofing business. There also has been a continuing trend on the part of architects to use natural textured and traditional treatments for the roof lines of new low-rise commercial and residential developments. The requirement of local authorities for adherence to traditional materials in renovation and rehabilitation of city

environments is also a major factor.

The increase in demand for roofing slate was met largely by imported material from Spain and, at the same time, investment programs were undertaken in several British quarries to raise both production and productivity.[1,2] The resultant picture of the UK roof slate industry over the past three or four years is one of consumption rising at a rate of 20 per cent per year, with 70 per cent of this increase being supplied by imports. The British market shows strong traditions, strong loyalties to particular slate from particular quarries and very marked regional preferences. If this were not so, imports may well have made even greater incursions during this period.

The consumption of slate for architectural uses other than roofing is estimated to be about 3,500 tonnes in 1987 and is therefore the minor part of the market.[3] Investment aimed at increasing the output of architectural slate was reported to be taking place at various quarries in the period 1983 to 1986.[4] Domestically, slate constitutes a very small part of the architectural dimension-stone market, by contrast with materials such as sandstone and granite, whether used as cubic stone or as panels. However, the British industry has for a time had considerable success in the export market for architectural slate. European markets have been largely lost to European-produced stone of various types but the US market has partly compensated and British slate exports to the US, of types other than roofing slate,

have risen by a factor of 4 or 5 since 1982/83 (Diagram 6). The Lake District slate producers for example, have invested in equipment to improve productivity and extend their range of shaped, polished and textured architectural components[5] and mounted extensive promotional programs to consolidate their position in the US market.[6]

Consumption

The British market currently consumes a total of about 50,000 tonnes of dimension slate per year. Production statistics are confused by the inclusion not only of large amounts of crushed slate, powder and granules but also of construction fill.[7]

Observers differ in their estimates of production[8,9,10] but a composite view is shown by the following estimates (Table 13) which show the growth in slate consumption to be about 20 per cent annually over the last three years. This represents 3 to 4 times the volumes of a decade earlier.

Table 13: Dimension Slate Consumption, United Kingdom
(thousands of tonnes)

	Roofing Slate				Blocks, Plates & Slabs
	1983	1984	1985	1986	1986
Production	19	22	24	26	3.5
Imports[3]	8[e]	15	14	19	6.9[1]
Exports[4]	1.5[e]	2.0	1.6	1.4	1.2
Apparent Consumption	25	35	36	43	9.2[2]

[1]90 per cent Italian slab material
[2]probably 3,500 tonnes true architectural
[e] estimated
[3,4] UK Government: Overseas Trade Statistics; British Geological Survey Worksheet.
Note: The trade figures include articles of agglomerated slate.

Production

There are five major slate producers in the UK. By far the largest is Penrhyn Slate Quarries Ltd. in North Wales. Penrhyn produces predominantly heather-blue and some blue-grey coloured roofing slate and a large quantity of slate powder granules. The company's deposits also include a number of other colours including green and red slate. Penrhyn has doubled its producing capacity during the past seven years,[11,12] and currently has plans for further expansion over the next three years. J.W. Greaves & Sons, Ltd., likewise located in North Wales, also produces predominantly roofing slate. The two quarries combined account for 65-70 per cent of domestic production. Several smaller firms, all but one in Wales, also produce roofing

slate. Certain small Welsh producers place considerable emphasis on architectural slabs and shapes since the softer and less cleavable nature of much of their slate favours these products.[13] Delabole Slate Ltd. produces a limited quantity of silver-grey slate in Cornwall, principally roofing for the southwest of England. Delabole also produces flooring and fireplace surround products.Their higher output of powdered slate and building stone is increasing in relation to their output of roofing slate. Burlington Slate Ltd. and Kirkstone Green Slate Quarries, Ltd. both in the Lake District of Northwest England, produce the harder green slate of volcanic origin which constitutes about 15 per cent of UK production and generally serves a different set of markets. Burlington also quarry deposits of blue-black and silver grey slate.[14]

From various interviews and comments received during the survey, the following appear to be the approximate shares of UK production.

Table 14:
Estimated Distribution of UK Dimension Slate Production
(per cent)

	Roofing	Architectural
Penrhyn Quarries Ltd.	55	small
J.W. Greaves & Sons Ltd.	15	1
Burlington Slate Ltd.	10	7
Kirkstone Green Slate Quarries Ltd.	1	3
Delabole Slate Ltd.	2	1
Other Quarries	6	2

Slate production elsewhere in England and in Scotland has been discontinued, although Scottish local authorities have expressed interest in the economics of re-starting production.

Imports

The volume of slate imported into the UK rose from 4,000 tonnes in 1978 to 26,000 tonnes in 1986, representing a rise from 15 per cent to more than 50 per cent of a market which itself has more than doubled during that time.

There were two principal components of this import trade. The first was the relatively steady quantity of slabs from Italy, amounting to between 6 and 8 thousand tonnes per year in recent years and almost entirely billiard table parts. The second component was that of the Spanish roofing slate imports, which have become a major competitive factor in the UK domestic slate market since 1980 and account for virtually all the roofing slate imports shown in Table 15.

Table 15: Dimension Slate Imports to the UK, 1986

Major Sources	Tonnes	Minor Sources	Tonnes
Spain	16,800	Eire*	1,400
Italy	7,800	France	900
		Portugal	800
		Benelux	400
		F.R. Germany	200
		South Africa	100
		Denmark	70
		China	40

Western Samoa is recorded as supplying 22 tonnes.
Note: *Eire is not a producer, but exports recorded as slate appear fairly steadily at this level to the UK.

Exports

The UK's annual exports of dimension slate have generally been in the range of 3 to 6 thousand tonnes per year for the past ten years. The US was the major single destination and the customs value of UK exports approached US$2 million annually in 1985 and 1986. The proportion of roofing slate exported to the US has dropped markedly since 1983, in spite of the rapid rise in imports there (Table 16 and 17).

Table 16: UK Dimension Slate Exports by Destination and Type
(tonnes)

	1984		1985		1986	
	US	All Countries	US	All Countries	US	All Countries
Roofing	773	1958	204	1617	201	1375
Blocks/Slabs	610	1072	1493	2663	884	1287
Other	-	563	-	495	101	694
Total	1383	3593	1697	4775	1186	3356

Table 17: Principal Dimension Slate Exports from the UK, 1986

	Tonnes
USA	1,190
Eire	510
F.R. Germany	390
France	320
Denmark	250
Netherlands	150

Table 18: Countries Receiving Minor Slate Exports from the UK, 1986

Belgium/Luxembourg
Greece
Switzerland
Austria
Canada
Australia
Saudi Arabia
Kuwait
Bahrain
Malaysia
Singapore
Hong Kong
Sierra Leone

Exports of all types of slate to Canada have been in the range of 50 to 100 tonnes per year.

There was a considerable, though apparently diminishing trade in rough or crushed slate to Germany, where crazy paving from the UK constituted a minor market in the 1970's.

Product Characteristics & Markets

Welsh "heather" blue is the slate roofing material which has set a tradition and a standard in the UK market against which other UK slates are judged. The size and quality of the slate deposits in North Wales have enabled these quarries to survive the long decline in the use of slate, which began in the 1930's and reached its low point in the mid 1960s.[15] Other local slates have created their own standards and regional preferences. Cornish grey slate, Lake District green and Welsh black have their own geographical markets and market segments.

Slates are bought very much upon the reputation of the quarry. Quality is judged by inspection, to a large extent subjectively. A slate 'rings' when tapped with the knuckles; grain is fine, grain is straight - or conversely fan-shaped; slate feels greasy and that indicates early spalling from acidic atmospheres, and so on. No specifications exist for pyrite inclusions and the British Standard Institution (BSI)tests are infrequently applied.

Although imported roofing slates have been a minor factor on the UK scene since the 1920's, the recent

appearance of large quantities of mixed lots from Spanish quarries has caused the British industry to take stock of its own production capabilities and economics on the one hand, and of its quality assessment procedures on the other. The British Standards for roofing slate are currently undergoing a major revision and meanwhile a technical bulletin issued by the National Federation of Roofing contractors in 1985 recommends the full application of the current BSI tests to properly representative samples of shipments (Appendix G-2).

A rather higher key promotional approach aimed at architects and planners is now being taken by some importers selling cheaper Spanish slate. Spanish imports seem, however, to be in the process of shaking out, as buyers become more critical of the variability in quality. The progress of these imports has been assisted by the long delivery times imposed by the British quarries and the business has attracted the entry of a dozen or so new small importers including a major concrete roof tile manufacturer who entered the natural slate import business in 1986, offering grey-blue Spanish roofing.[16] The larger and established dealers have long-standing ties with specific Spanish quarries, and have maintained good quality Spanish supplies in large volume. The price of Spanish slate, including the importer's markup, is increasing relative to UK slate. In certain cases this year, it has reached 75 to 80 per cent of the Welsh price.

Welsh slates (and also Spanish imports) are sold almost exclusively in specified sizes. These conform to an extensive standard range, which also includes slate-and-a-half dimensions. Slates are generally priced by the thousand rather than as laid measure, and a premium applies for larger size. Since slates are lapped in a roofing installation, larger sizes impose less weight per unit area of cover, and require less installation labour (Appendices L and M).

Similarly, a price premium applies to thinner slates, and these premiums reflect not only the advantage to the user but the relative difficulty, and hence yields and costs, of producing larger and thinner slates.

Prices of slate from UK quarries vary according to type and origin. A typical current "marker" price for roofing slate in 1987, delivered to a major dealer or "factor", would be £1,600 to £1,700 per thousand of 610 x 305 x 5mm slates, versus £800 to £900 per thousand for the equivalent Spanish product.[17] Factors' mark-ups on Welsh slate are 2.5 - 5 per cent and 15 - 20 per cent on Spanish.

Both Delabole slate and Greaves slate are said to command a premium. Lake District roofing slates, whether green or blue-grey, are generally sold as random widths at a specified length. They are cleaved thicker and occupy a much higher price range. Burlington, for instance, quote a price of about £4 per sq ft laid measure for green randoms, which corresponds to about 2.5 times the list price for

Welsh best sizes at 610 x 305 x 5mm.

There appears to be little regular (as opposed to Lake District) green slate used in UK roofing. One major dealer's opinion is that green slate is identified with thickness and with the characteristic texture which is given to a roof by virtue of both the thick slate and the texture of this particular stone's cleft surface. On that basis he considers that a thin green would not sell.[18]

Otherwise, colour preference for roofing slate in the UK is almost entirely for the grey-blue-black range. Reference is occasionally made to "plum", and it seems this often refers to the Welsh heather blue slate just as does the term "purple". Purple roofs of the Newfoundland/Vermont colour can also be seen in the UK.

Small slates sell relatively better in Cornwall and in Scotland, partly on account of tradition and perhaps based on a lower susceptibility to wind damage.

Very little new residential roofing is of slate and it is estimated that the balance of 70 to 80 per cent of roofing slate sales is principally for prestige commercial institutional and civic projects. Current architectural styles have tended to revert to pitched roofs, particularly for low-rise developments in the town-house market, for city centre developments, industrial/office buildings and shopping centres.

"Historic" conservation projects, church renovation and

urban renewal markets constitute an additional part of this demand for slate roofing in the UK. Although there is also considerable re-use of old roofing slates for these applications, local authorities' specifications for exact replacement by slate from the original origin, is an important influence. High priced residential renovation both in country houses and in cities such as London, constitute a minor but significant demand. Only 20 to 30 percent of slate roofing is directed at the repair market and part of this is satisfied by the re-use of old slates.

Although the tendency of some architects to return to natural textures may be a contributing factor to this resurgence in slate roofing in the UK, there is little to suggest that it is an important influence in the architectural facings and paving market. The UK is not an architectural slate market as are areas of Western Europe and imports are of relatively small quantities. One example is Italian slate which is not generally suitable for exterior application. Smaller quantities figure in the polished and "marbled" floor tile and fireplace product lines of stone masonry firms. Centuries of a strong brick industry and a tradition of use for indigenous building stones apparently have precluded the rise of slate as an important material. However, a proportion of major construction projects use architectural slate and some are listed in Appendix I.

Footnotes - UK

[1]Stone World, February 1987, p. 59.

[2]Stone Industries, December 1983, pp. 24-32.

[3]Private communication, D.C. Wallace.

[4]Stone Industries, March 1986, pp. 24-32.

[5]Stone World, September 1987, p.50.

[6]Stone Industries, October 1985, pp. 28-29.

[7]Industrial Minerals, May 1986, pp. 31,32.

[8]Ibid.

[9]Industrial Minerals, July 1985, p.15.

[10]USBM Yearbook, 1985, p.22

[11]Industrial Minerals, May 1986, pp. 31,32.

[12]Private Communications D. Burroughs.

[13]Stone Industries, March 1986, pp. 24-32.

[14]Stone Industries, October 1985, pp. 28-29.

[15]USBM Yearbook, 1985, p. 22.

[16]Industrial Minerals, February 1987, p. 15

[17]Private communication, J. Ditchfield.

[18]This view is not universal. Another dealer indicated that he would like to have a source of sound durable green roofing slate to sell.

Eire and Northern Ireland

The Irish market, at around 1,300 tonnes, is small in terms of global consumption patterns. All the slate used, however, is imported and the market has been perceived as a possible growth area. The use of slate for roofing is well-developed and slate flooring is an area where additional marketing input could stimulate demand.

General

Prior to the 1930's, the largest segment of the roofing market throughout Eire was clay tile. Quantities of slate were also used, especially in the South, where green and blue-grey slates occur in County Kerry and County Tipperary. Demand for natural materials such as clay and slate fell after World War II and Irish slate quarrying ceased around this time.

An exception within an otherwise depressed construction industry, roofing (including repair) seems to have held its own over the past five years. It is, nonetheless, highly price sensitive. This factor has often caused low price to take precedence over a higher quality of materials and better workmanship, as specifiers and state bodies have left major roofing contracts in the hands of the builder as a sub-contract.

The importance of price is reflected in the split

between the public and residential use of slate roofing tiles. 70 per cent of the natural slate roofing market lies within the public building sector. The remaining 30 per cent consists of roofing applications for residential properties in the higher price bracket from £45 - 60 thousand up to £150 thousand.

Despite keen competition, one importer[2] accounts for 80 per cent of natural roofing slate imports. In addition to slate roofing tiles, this company's extensive product range includes clay tiles and fibre-cement roofing products.

The major importer has developed two routes by which building contractors are supplied. One is through direct contact with contractors and the other by means of selling to some 200 - 250 merchants who in turn supply the slate to contractors. The merchants work with the importer's four representatives round the country to promote the use of natural slate roofing tiles.

Possible future changes in the structure of the industry could include more specialization such as has happened in the UK. There, the DIY trade is now dealt with in DIY outlets, heavy construction business has stayed with the previous traders and roofing has moved to specialized centres.

Slate flooring is a minority application in Eire, with around one hundred tonnes being consumed in 1986, which was 7 per cent by weight of the total slate imported. A

potential demand for slate flooring may exist but sales are currently at such a low level that no company can justify the substantial publicity investment required to develop this market segment.

If the quantity of slate used for floor-covering is small, the architectural segment of the market is even smaller. Applications such as cladding, worktops and fire-places accounted for 3 per cent of the slate consumed in 1986.

Consumption

As Eire no longer produces slate, the overall consumption can be derived from the official import statistics, as the Irish figures give no exports. Cross-reference to the UK figures shows imports to the UK from Eire and this anomaly has not been resolved.

The above procedure, based on 1986 figures, results in a consumption figure of 1,300 tonnes, 1,200 tonnes of which is roofing slate. Total slate consumption between 1981 and 1986 fluctuated around 1,250 tonnes annually with the exceptions of 1983 (800 tonnes) and 1985 (3,000) tonnes.

Sources of Supply

Roofing slate imports are as follows:

Table 19: Irish Sources of Roofing Slate

Colour	1986 Imports in tonnes	Source
Black, grey and blue-grey	1,000	Spain, England
Blue	100	Wales
Other	60	England, Italy

The bulk of imports are black and grey from Spain and England. The current market for green and purple is 60 tonnes or less. Lower prices and shorter lead time on orders could lead to expansion of this segment.

Product Characteristic Preferences

In general, roofing slates are used in standard sizes from 24 x 12in down. The exception to this are green and Welsh blue (purple) tiles for which the 24 x 12in size only is used. It may well be the case that demand for this specialized product exceeds supply, as there is a six-month waiting list for them.

Most of the roofing slates used are the thinner (3.5mm) Spanish variety. Spanish slate was quoted as being of a poorer quality than the other slate used but it has a

than man-made materials. Despite the manufacturer's offer of a 150 year guarantee, a representative from the trade estimated that a roof covered with Spanish slate tile will last about 40 years.

Manufacturers' claims generally have fallen into disrepute within the roofing industry. Great store is set by actual experience with slates from a particular source as to how they stand up under the adverse Irish weather conditions. The British Standard for roofing slates is well-recognized as an indication of appropriate quality.

Price

Import values derived from the official statistics via the Canadian Embassy in Dublin gave the following picture over the last six years:

Table 20: Average Import Values, Eire

	1981	1982	1983	1984	1985	1986
C$ per tonne	570	670	640	540	430	820
Irish pounds per tonne	290	380	420	380	290	440

Prices of roofing slate to the end-user were quoted by the major slate importer as prices per sq m of roof covered, as shown in Table 21.

Table 21: 1987 Average Prices, Ireland*

Roofing Material	C$ per sq m of roof covered
Man-made look alike	15
Spanish	25
UK good quality	35
Green	70

Source: Capco, Eire.
* Includes distributor and merchant margins.

The high price commanded by green slate is no doubt because the green used is slate such Burlington which is a higher-priced commodity. Demand for this material is in excess of supply, as indicated by the lead time of six months on orders.

Footnotes - Eire

[1]Equivalent to C$90-120 thousand up to C$300 thousand.

[2]The importer, Capco, supplies both Northern Ireland and Eire. Their comments, on which much of this section is based, apply to both countries. Official statistics originate from the Irish government in Dublin and apply solely to Eire.

France

France is one of the world's largest users of worked dimension slate with a 1986 consumption of 207,000 tonnes[1] 152,000 tonnes of this being imported. The country also exports slate, largely in rough form.[2]

General

Historically France has exploited her own reserves of natural slate for local slate roofs. Since the early 1970's, French production has decreased due to competition from cheaper Spanish slate and from other roofing materials such as clay and concrete tiles. The construction industry has also taken a downward turn since that time due to a decrease in housing starts. 90 per cent of the dimension slate currently used in France (185,000 tonnes) is estimated to be roofing products.[3] Included in this is a certain amount of restoration and repair slate, for which matching roofing tiles may be required. Official figures for cladding are combined with roofing and the cladding market share is estimated at 5 per cent. Flooring is a minority application accounting for the remaining 5 per cent.

Consumption

In 1986, French consumption of worked slate was around the 207,000 tonne mark. This figure was derived from the following statistics:

Table 22: 1986 French Worked Slate Consumption
(tonnes)

	tonnes
Production	58,000
Imports[4]	152,000
Exports	3,000
Consumption	207,000

Source: French Government Statistics

Additional exports of 41,000 tonnes of rough slate were recorded in the 1986 government statistics. Government production statistics, however, do not include rough slate[5] and the figures quoted in this section relate to worked slate, 90 per cent of which is used for roofing applications.

French worked slate consumption data derived from the official statistics indicate a decreasing trend from a figure of 226,000 tonnes in 1981 to the 1986 figure of 207,000 tonnes discussed above (Table 22). The decreasing trend identified concurs with recently intensified competition in the roofing market.[6]

Table 23: French Worked Slate Consumption 1981 - 1986
(thousands of tonnes)

1981	1982	1983	1984	1985	1986
226	201	180	230	212	207

Source: French Government Statistics.[7]

A study recently carried out by a large consulting firm in France[8] predicted a steadying of consumption from 1986 to 1991, with no huge upward or downward swings expected.

Sources of Supply

Around 75 per cent of the slate products used in France in 1986 were imported, compared with 60 per cent in 1981. during the intervening period, production has dropped and imports have increased, though by a lesser amount, leading to an overall reduction in the tonnage of slate consumed.

Spain supplied 99 per cent of France's imported slate over the past five years to 1986. Imports from Spain have increased somewhat, as have those from the UK (at a much lower level). The French statistics show imports from Italy ceasing after 1983 but the statistics from Italy indicate that trade continued from 1985 at roughly the same level as shown in Table 24.

Table 24:
1981 - 1986 French Sources of Imported Worked Slate
(tonnes)

	1982	1983	1984	1985	1986
Spain	131,000	136,000	172,000	155,000	150,000
Finland	-	-	-	-	-
Italy	810	390	-	-	-
UK	80	140	130	160	290
Others	70	190	300	120	210

The majority of Spanish imports go towards roofing applications. No doubt some proportion of imported slate goes towards supplementing domestic production of slate for architectural and flooring uses and for specialized roofing requirements such as restorations.[9]

The bulk of French slate (60 per cent) is quarried by Ardoisières d'Angers, Western Europe's largest roofing slate producer. The company is also a major importer and re-exporter of Spanish slate and in addition to trading activities, is involved in the manufacture of other building and roofing products. These include Ardal, an external cladding product, which utilizes slate waste. The remaining 40 per cent of French slate is produced by some 20 small companies. Another large producer used to operate in Anjou but this company experienced financial difficulties in the latter half of 1987, which have resulted in bankruptcy.[10]

Other producers are also engaged in exporting activities especially of higher grade French slate, one recipient of which is the US. Efforts are being made to develop exports, as high production costs are difficult to recoup on the domestic market due to competition from low-priced Spanish slate.

Product Characteristic Preferences

Slates from the UK are thickest at 5mm, then Spanish

grey slates at 3.5mm and French slates (2.7mm). Difficulty with quarrying has resulted in the evolution of domestic French roofing slates to a size of 30 x 20cm, which is smaller than most other European slates. Imported slates are 40 x 40cm, 60 x 30cm, 46 x 30cm, 40 x 24cm and 33 x 23cm. Slates in France are hung by hooks rather than being nailed.

One import company indicated that 85 per cent of the slate used is blue-black, 10 per cent is dark green and 5 per cent purple. 70 per cent of roofing tiles are Spanish and therefore blue-black, grey, or green. French slate is black, green and blue-green. Purple Ardennes slate has often been used on historic buildings.

Imported slates have to comply with the French standard NFP32.301, or foreign exporters have to obtain agreement from the French Department of Industry. This import regulation of October 1977, renewed in October 1983, was implemented by the French government in an effort to reduce imports, but with little success.

Price

Price appears to be an important factor in the French slate market. The bulk of roofing slates are imported from Spain at an average price per tonne of about half that of French slates[11]. Imports of more expensive slate from other countries have decreased over the last six years.

The weighted average value per tonne of worked slate imported to France varied over the last six years as shown in Table 25.

Table 25: Average Import Values - France

	1981	1982	1983	1984	1985	1986
C$ per tonne	373	327	218	264	305	362
French francs per tonne	1620	1740	1590	1780	1990	1800

Against a slight overall inflationary trend, average slate values fluctuated considerably from year to year, also varying depending on the source country. The small quantities of slate from the UK are consistently the most expensive slate imported by France as shown in Table 26.

Table 26: Average French Import Prices of Worked Slate
(C$ per tonne)

	1981	1982	1983	1984	1985	1986
UK	780	720	610	780	650	780
Spain	370	330	260	260	300	360
Finland	340	-	-	-	-	-
Italy	210	230	210	-	-	-
Others	370	680	400	310	450	510
Weighted Average Price	370	330	260	260	310	360

Should the decreasing trend in French slate consumption steady off, a shortfall in supply may occur due to the closure of one of the major domestic producers. This may be compensated for by increased imports from Spain or by increased sales on the part of Ardoisières d'Angers.

Footnotes - France

[1]Derived from French Government statistics.

[2]1986 exports were 41,000 tonnes (2514) and 3,000 tonnes (6803) for rough and worked slate respectively.

[3]Market segmentation information from communication with a French dealer.

[4]France re-exports slate of Spanish origin (Industrial Minerals, May 1986). Import statistics may be inflated by slate passing through France.

[5]The 1984 government production figure is 59,000 tonnes. For the same year, Robbins (Industrial Minerals, May, 1986) quotes 111,000 tonnes as the total production, a figure which includes slate by-products and rough flagstones, in addition to 64,000 tonnes of roofing slate.

[6]Canadian Embassy, Paris.

[7]Robbins (Industrial Minerals, May 1986) presents a set of production and trade figures which indicate a 1984 roofing slate consumption of 232,600 tonnes.

[8]Canadian Embassy, Paris.

[9]Industrial Minerals, May 1986.

[10]Canadian Embassy, Paris.

[11]Industrial Minerals, May 1986

Spain

Spain's annual production of slate comprises about 300,000 tonnes of dimension slate, which makes the country the world's largest slate producer. 1,000,000 tonnes or more of waste slate is co-produced for use in cement and aggregates. Spain's three biggest quarries each produce more than 30,000 tonnes of roofing slate per annum.

Low production costs have led to Spanish slate being very competitive in export markets. Quality, however, is variable. Despite this, Spain ranks as the world's largest dimension slate exporter. Of the 260,000 tonnes produced in 1985, 228,000 tonnes[1] was exported and probably about 30,000 tonnes of domestic production was used for roofing applications within Spain. Annual import levels are low; 500 tonnes was imported in 1985.

Around 12 per cent[2] of the domestic roofing market uses slate products. The clay pantile at 20 pesetas (23¢) each is the most commonly used roofing material in Spain. Concrete tiles made by Redland are also used. As in most other countries, slate is one of the more expensive roofing materials, although it is the poorer quality slates which are retained for local use. Slates have traditionally been used on domestic buildings in areas near the quarries and are now utilized on some new buildings in Madrid and Barcelona.

95 per cent of Spanish-produced slate used in Spain is for roofing applications. The remaining 5 per cent is divided between flooring and architectural uses. The architectural segment is small and slate staircases, fireplaces and swimming pool surrounds are rare. Recently, efforts have been made to promote more domestic use of slate as a flooring material.

Production and Consumption

The slate production industry in Spain, as elsewhere, is labour intensive but wages are relatively low. Certain groups of small quarries have formed cooperatives for marketing purposes. On the other hand, links exist between some mines and foreign trading companies, resulting in long-term contracts. Other minor quarries are controlled by foreign companies who buy and market the output. The West Germans are increasingly buying slabs of Spanish slate by weight and cutting and finishing roofing tiles in their own country. West German companies now employ quality inspectors on a large scale to check their purchases from Spanish quarries.

The Spanish government has recently sponsored the setting up of a number of importing companies in the main countries to which Spain exports.

Production and export quantities are shown in Table 27.

Table 27: Spanish Production and Exports
(thousands of tonnes)

	1980	1981	1982	1983	1984	1985
Total Production[1]	1,040	1,760	1,220	990	1,160	1,580
Total Exports[2]	161	166	165	182	247	228

[1]Source: Official Spanish government statistics. The local association of geology and mining, IGME, placed 1985 production at 3,100,000 tonnes, which comprised 2,600,000 tonnes of slate waste and 460,000 tonnes of dimension slate.

[2]Source: Industrial Minerals, May 1986. The majority of exports are roofing slate.

Although total production (including dimension stone and by-products) displays no obvious sustained growth, exports have increased fairly steadily since 1980, apart from the decrease in 1985. There was a partial recovery in 1986 which was continued in 1987. 1988 volumes are expected to equal those of 1987.

Of the 1983 production of just under 1 million tonnes, around 60 per cent was used in aggregates and just under 20 per cent consumed by the domestic cement industry.[3] The calculation of Spanish slate consumption is frustrated by the large quantity of non-dimensional slate produced, some of which is incorporated into products for export (for instance, reconstituted slate and resin bonded tiles).

Exports

The growth in Spanish exports has been distributed over

existing markets as shown in (Table 28).

Table 28: Spanish Slate Exports[4]
(tonnes)

	1980	1981	1982	1983	1984	1985
France	132,600	138,000	138,500	139,900	177,900	155,000
FRG	16,300	16,200	15,200	21,700	39,100	39,600
Belgium	7,400	6,300	6,300	9,400	14,200	15,400
UK	1,900	1,500	1,800	6,500	11,200	12,400
Andorra	2,400	2,600	2,400	2,000	1,900	1,700
Australia	300	400	600	300	500	900
Other	600	1,700	1,100	1,900	2,600	3,100
Total*	161,500	166,400	165,400	181,700	247,300	228,100

**discrepancies due to rounding to the nearest hundred.

France is the recipient of between 70 and 80 per cent of Spanish slate exports. West Germany, at around 15 per cent, is the second most important export destination with Belgium importing about half that amount. The UK, Andorra and Australia have also been significant importers of Spanish slate over a number of years (Table 28). Quantities of around 300 - 400 tonnes have on occasion been imported by Switzerland, the Canaries and Denmark. More recently, the US, Eire and the Netherlands have been increasing their consumption of Spanish slate. 1985 levels were 1,000 tonnes(US), 600 tonnes (Eire) and 500 tonnes (the Netherlands). In the same year, quantities of slate in excess of a hundred tonnes were supplied to Chile, Argentina and Saudi Arabia.

Price

Table 29 shows export values per tonne of roofing tiles as assigned in the trade statistics.

Table 29: Weighted Average Dollar Values of Spanish Export Slate
(C$ per tonne)

	1980	1981	1982	1983	1984	1985
Exports	430	330	310	250	260	300

Exports show a decreasing trend in C$ values but reconversion to peseta values (Table 30) identifies an increasing trend.

Table 30: Weighted Average Peseta Values of Spanish Slate
(thousands of pesetas per tonne)

	1980	1981	1982	1983	1984	1985
Products*	2.8	1.9	3.1	4.2	4.7	4.3
Imports	22	14	11	17	64	58
Exports	26	26	27	29	32	37

*Mine site values (dimension slate plus by-products)

Within these categories, as is to be expected in the slate trade, there was huge variation. The 1986 range for one company's products was 400 - 1,800 pesetas per sq m.[5] This is equivalent to C$4 - 17 per sq m. The weighted average values ex-quarry given by government statistics reflect the huge weights of cheaper slate by-products which are produced.

Product Characteristics

Domestic slate production is over 95 per cent blue-black to grey. The remainder is dark green which is produced to order. Some Spanish slates are hard and in certain cases imports are brought in for applications which require the slate to be worked as in the case of Portuguese slate for billiard tables, some of which are then re-exported. Many Spanish slates contain iron pyrites which can reduce their life span when used as roofing tiles.

Roofing tiles are sized according to their destination. Most of England prefers large slates whereas Scotland and Northern England will buy slates which are 40 x 25cm or 40 x 20cm. Belgium will not buy slates thicker than 4mm and also prefers smaller sizes. France and West Germany too buy smaller slates. Spanish exporters also find that certain areas within each country display variations of colour preference in addition to required sizes.

That Spain so successfully supplies this variety of roofing products at competitive prices, shows the country to be a formidable competitor in the slate trade.

Footnotes - Spain

[1]Spanish government statistics for the years 1984 - 1986 show negligible imports and exports of slate in category 2514. The data presented in this section pertains to category 6803. 1982-1984 statistics for 6803 exports agree with those quoted by Dimensional Stone, Jan/Feb 1987, as dimension stone exports.

[2]Industrial Minerals, May 1986.

[3]Ibid

[4]1986 exports can be estimated at 240,000 tonnes and 1987 exports at up to 300,000 tonnes (private communication with a dealer).

[5]Industrial Minerals, May 1986.

Federal Republic of Germany

Production of all types of slate in West Germany has decreased from a total of 270,000 tonnes in 1980 to 70,000 tonnes in 1985.[1] In 1983, production was divided into around 10,000 tonnes of dimension slate and 77,000 tonnes of rough slate, powder and granules. The large powder and granule production is utilized in a range of locally manufactured construction materials.

The majority of the dimension slate used in West Germany is blue-grey in colour and used for traditional roofing and cladding applications. Imports increased from 70,000 tonnes in 1983 to 107,000 tonnes in 1986, of which 70 per cent originated in Spain.

Many tile shapes exist and roofing installations are at the expensive end of the market. Flooring is a minority application.

General

The most popular roofing material in West Germany is clay tile. Slate has around 5 per cent of the total roofing and cladding markets and is considered an expensive option as the "flake" shape tiles are costly to produce and expensive to install. One slate trader expressed the opinion that although the number of building starts is currently depressed, the use of expensive materials in higher priced construction remains.

Slate's share of the roofing and cladding markets has recently increased. Anticipating further market growth due to the withdrawal of asbestos products, some German producers have been modernizing their mining equipment[2] with the objective of increasing yields. Others have been running more than one shift.[3] However, one trader reckoned that growth over the last three years has now stabilized.

Most residential floors are carpeted, with the exception of kitchens and halls where ceramic tiles are popular. Slate is rare although there is some local production of flagstones.

Consumption

The 1986 consumption of dimension slate was estimated at around 70,000 tonnes (Table 31).[4] Figures are confused by the inclusion of crushed slate, powder and granules in addition to the considerable volumes of artificial slates traded.

Around 60,000 tonnes or 90 per cent of West German slate production in 1983 was in crushed and ground form, used for the production of concrete aggregates, powders for fillers, and powders and granules for roofing products. These products, which utilize waste slate, are used in increasing quantities.

Including crushed and ground products, slate consumption remained fairly steady from 1983 (144,000 tonnes) to in 1985 (149,000 tonnes).

Table 31: Estimated West German Slate Consumption
(tonnes)

	1983	1984	1985	1986
Imports	70,000	103,000**	101,000	107,000
Total Production	87,000*	n/a	70,000*	n/a
Dimension Slate Production	10,000*	n/a	n/a	n/a
Total Consumption	144,000	n/a	149,000	n/a
Exports†	13,000	18,000	22,000	18,000
Estimated Dimension Slate Consumption***	50,000	70,000	60,000	70,000

Source: Import & export figures from West German government statistics.

* Source: Industrial Minerals, May 1986.
** Figure quoted in Industrial Minerals, May, 1986 concurs with official statistics.
***Estimated from the 1980 figure of 50,000 tonnes derived from Industrial Minerals, May 1986.

Sources of Supply

Rough slate is supplied mainly by France and Portugal. The major single supplier of roofing/cladding slate is Spain which exported 40,000 tonnes to West Germany in 1985. The balance was mainly supplied by Italy, the Netherlands, the UK, Belgium/Luxembourg and Portugal. Italian sales to West Germany have levelled off.[4] Blackboard slate comes mainly from Belgium and the Netherlands.[5] Table 32 shows the average import values.

Table 32: West German Average Import Values
(C$ per tonne)

	1980 C$	1984 C$
Crude & prefabricated	170	88
Blocks & slabs	520	450
Ready for roofing	460	290
Other products	690	530

Though prices appear in C$ to have dropped in all categories between 1980 and 1984, in deutschmark values, only crude and roofing product prices have decreased.

Industry Structure

There are a small number of highly competitive slate trading companies in West Germany, many of whom also mine slate. They have a traditional reticence to discuss their distribution systems or pricing. Some production companies are heavily involved in importing and one operates through a network of associated companies in source countries. Some roofing slates are imported from Spain already prepared; others are finished in West Germany.

Product Characteristic Preferences

Roofing slates come in a large variety of shapes and sizes. An example is shown in Appendix X. The "flake" shapes are 11 x 11cm to 50 x 42cm, and rectangular shapes are 25 x 15cm to 60 x 35cm. Roofing and cladding tiles are hung on hooks, or by frames attached to the slates.

One trader indicated that the slate used is all of a blue-grey colour and there is no demand for other colours.

Germany is the origin of the DIN standards which are also the recognized standards in several other European countries (See Appendix G-3). West German roofs are generally guaranteed for 30 - 50 years.

Footnotes - West Germany

[1]Production data from Industrial Minerals, May 1986. Source: 1980 - 1983 West German government statistics, 1985, estimated.

[2]Stone Industries, January/February 1987.

[3]Private communication with a US trader.

[4]Private communication with a UK dealer.

[5]Blackboard slate described by government data as imported from the Netherlands will originate elsewhere as the Netherlands produces no slate.

Belgium and Luxembourg

Belgium and Luxembourg combined, import around 35,000 tons of slate per annum. Spain, France, West Germany, Portugal and India are the main sources of imported slate. Production figures were not available but exports from Belgium/Luxembourg are around 3,500 tons each year.[1]

General

Flooring applications constitute an estimated 50 per cent[2] of the slate market. Some domestic floor tiles are produced, supplemented by a fair quantity of imports.

The slate roofing market segment in Belgium & Luxembourg comes a close second to flooring and it has been estimated that 40 per cent of the total slate used goes towards roofing. Restoration roofing uses Belgian, French or Welsh slate and new installations, black Spanish slate. Belgium also exports roofing slates to France.

The architectural segment of the market is quite small and does not exceed 10 per cent of total slate consumed.

One large company dominates the slate market in Luxembourg. In Belgium, a small number of large companies include slate in their range of natural stone products. Several smaller companies specialize in slate products. Importers are listed in Appendix J-1.

Many colours of flooring tiles are used in the two countries and one of the largest importers referred particularly to sizes of 40 x 40cm and 30 x 60cm which are generally about 10mm thick.

Roofing tiles, which are rectangular in standard sizes, are also supplied in several colours. The Spanish blacks are thinner than most others.

Consumption

As production figures were not available, only the lower limits of the slate tonnages utilized within Belgium and Luxembourg can be derived by deducting exports from imports.[3] Consumption, therefore, was in excess of around 30,000 tonnes annually over the last seven years to 1986, with no obvious trends identified. An estimate of domestic production of 20,000 tonnes[4] would place consumption at 50,000 tonnes.

Price and Sources of Supply

The unit values for customs purposes placed on slate imports entering Belgium and Luxembourg are shown in Table 33.

Table 33: 1986 Average Customs Values of Slate Entering Belgium & Luxembourg
(tonnes & C$ per tonnes)

	tonnes	C$ per tonne			
	Imports	Roughly Worked	Roofing & Cladding	Blocks, Tables	Other
Greece	0.6				2,300
Norway	400	650	1,300	1,000	
China	77	530			
Sweden	140	480			1,100
Italy	830	430		930	1,100
Portugal	1,900	330	420	340	360
S.Africa & Namibia	420	290			
India	1,700	270		280	
Netherlands	810	220	980	860	560
Brazil	24	150			
UK	150	100	720	890	120
FRG	2,800	99	640	970	160
France*	15,000	55	600	1,000	260
Austria	23		590		
Spain	15,000		540	320	
Egypt	24		24		
Zimbabwe	40			23	
Weighted Average		100	550	480	470

Source: Belgian National Institute of Statistics.
*Imports from France are probably of Spanish origin.

The majority of slate is imported from Spain and France. The Spanish slate is in the form of roofing tiles at C$540 per tonne. The French slate is mainly rough at C$55 per tonne.

Footnotes - Belgium and Luxembourg

[1]The figures quoted for imports and exports over the period 1980-1986 are averages of trade data from the Belgian National Institute of Statistics.

[2]Market segmentation information from interview with a dealer.

[3]Trade data from the Belgian National Institute of Statistics.

[4]Estimated production is based on 11 companies/quarries each of which mines 1,800 tonnes per annum, the quantity quoted by Robbins (Industrial Minerals, May 1986) as being produced by one quarry in 1979. This estimate may be on the high side.

Netherlands

No slate is produced within the Netherlands. In 1985, imports amounted to 35,000 tonnes,[1] mainly for flooring applications. About a tenth of the quantity of slate imported each year is recorded as exported. The 3,500 tonnes recorded in 1985 were valued at $477 per tonne as opposed to an average import value of $170 per tonne, which reflects further processing being carried out on imports prior to exporting, or the possibility that some high-priced materials are passing through the Netherlands. These export figures appear low when set against comments from the industry on the volume of re-export trade such as the green slate from Northern Norway, which is sold by the Dutch in the heavy floor tile market.

General

The growth area of the slate market is in flooring, which used to be largely confined to public buildings. The material is now becoming popular for residential properties as well. Flooring applications accounted for 75 per cent of the slate used in 1985.[2] During the last five years, consumer tastes have swung away from dark colours, towards white polished flooring. This phase is now nearing its conclusion, with tastes tending towards "more friendly" colours.

One large company dominates the slate flooring market. Two other large companies supply most of the rest, with several smaller companies making up the balance. The traders sell to middlemen who then supply end users.

Roofing is a minority application for slate and small quantities of slate are used for cladding. Together, these market segments total 9,000 tonnes and form 25 per cent of the total market for slate.

Consumption

On the basis of imports less exports, there being no production within the Netherlands itself, annual consumption has been placed at 35,000 tonnes valued at C$6,000,000.

Traders' impressions of whether slate consumption is decreasing or increasing varied. A company which estimated it has 60 per cent of the slate flooring market, reported a growth in that segment. Another company, which used to stock slate flooring but no longer does so, was of the opinion that demand for natural flooring was decreasing.

The consumption figures derived from the official trade statistics fluctuated as shown in Table 34.

Table 34: 1980-1986 Dutch Slate Consumption
(tonnes)

1980	1981	1982	1983	1984	1985	1986
53,000	39,000	37,000	32,000	44,000	31,000	35,000

Apart from 1984's figure, there has been a general decrease in annual consumption. The slight upward turn in 1986 may indicate the start of a growth period as indicated by one trader.

The bulk of the slate enters the country through France, Belgium/Luxembourg and West Germany. Details of import sources are shown in Table 35.

Table 35: 1986 Slate Imports to the Netherlands
(tonnes)

	Rough Slate	Tiles/Shingles	Blocks/Panels/ Tiles	Other	Totals
France	15,000	760			15,760
Belgium/Lux.	9,900	40			9,940
West Germany	4,400	100	50		4,550
UK	90	110			200
Eire	200				200
Portugal	640		140	250	1,030
Norway	1,800		680	150	2,630
S. Africa	840		100		940
India	820				820
China	2,000		100		2,100
Spain		330		60	390
Italy			210		210
TOTALS	35,690	1,340	1,280	460	39,000

Source: Dutch Government Statistics.

The 1986 Dutch import statistics do not cross-check with export statistics from Norway and Belgium/Luxembourg. 2,600 tonnes are recorded by the Netherlands as imported from Norway whereas Norwegian statistics show the much greater figure of 15,000 tonnes exported to the Netherlands. Imports from Belgium/Luxembourg are recorded by the Netherlands as 9,940

tonnes and by the source countries as exports of 120 tonnes to the Netherlands. Discrepancies may be connected to the Dutch statistics recording an intermediate point of origin to the Netherlands rather than the original source of the slate.

Product Characteristic Preferences

Past preference in flooring has been for black and grey, such as slates from Norway, which were often used with brown (Indian mottled red) slate tiles. Other colours, such as green and red, are becoming more popular.

Floor tiles are often ungauged and 1-2cm or 1-2.5cm thick. Larger sizes are preferred, such as 60 x 30cm or 40 x 40cm, and a reasonably smooth cleavage is desired. Exterior paving slabs are 120-160cm long, 40-60cm wide and 3-5cm thick.[3]

Price

The Netherlands buys slate from a number of sources, as shown in Table 35. The large tonnages imported are of cheaper slate.

Traders indicated that Norwegian slate at C$65 per sq m was the most expensive, followed by Indian at C$40, then Chinese at an estimated C$20 (1986 prices per sq m). This range of prices and of slates purchased shows the variation of demand for slate in the Netherlands, albeit largely within the flooring market.

Footnotes - Netherlands

[1]Dutch Government Statistics.

[2]Market segmentation information derived from traders' comments.

[3]Sizing and colour preferences indicated by major flooring company.

Italy

Italy's annual domestic production of slate is around 80,000 tonnes and the country exports 36,000 tonnes of this. Imports, mainly in category 2514 from France, are around 8,000 tonnes a year, which places consumption at 50,000 tonnes per annum.[1]

Although slate is used locally for a variety of roofing, flooring and architectural applications, Italy is known as the traditional supplier of the best slate for snooker and billiard tables.

The country's quarries handle both the processing and export of slate products. Around 33,000 tonnes of 1985 exports were processed form (i.e. 6803) and of this, 24,000 tonnes were classified as 6803.1600, the table, floor tile and slab category. 900 tonnes were classed as roofing and 7,700 as other. 3,000 tonnes were exported in rough form (2514).[2]

An indication of export trends is given by Table 36.

Table 36: Italian Slate Exports
(tonnes)

Country	1980	1981	1982	1983	1984	1985	1986
US	22,000	21,000	7,700	7,500	8,400	8,900	8,900
UK	-	3,100	5,100	7,600	6,600	10,000	7,200
Saudi Arabia	-	-	-	960	-	-	1,600
FRG	-	650	-	330	570	690	750
France	900	1,300	510	670	-	500	730
Hong Kong	-	-	-	-	-	1,400	500
Canada	1,000	630	430	540	300	670	480
Ireland	-	-	-	-	-	-	170
Australia	2,200	2,100	1,600	740	-	160	74
Thailand	-	-	-	-	170	780	-
Japan	1,100	-	260	-	-	-	-
Switzerland	380	-	120	-	-	-	-
Other	11,400	8,200	7,300	4,700	9,900	9,900	12,600
TOTAL 6803*	38,000	37,000	23,000	23,000	25,000	33,000	33,000
TOTAL 2514*	n/a	n/a	n/a	n/a	2,600	2,900	3,000

Source: Official Italian Government Statistics.
* Discrepancies due to rounding.

The Italian figures show exports of worked slate to the US decreasing in 1982 to a third of the 1981 tonnage. Cross-reference to the US statistics is impeded by the large category of "other" contained in the Italian statistics and the lack of 2514 data prior to 1984. In addition, the US data is collected on a different basis[3] and presented by customs value rather than tonnage.

Footnotes - Italy

[1]Based on 1984 figures, Industrial Minerals, May 1986.

[2]Italian government statistics.

[3]US data is collected for two categories of slate, roofing (515 1100) and other (515 1400), while Italian statistics follow the European pattern of categorizing slate into rough (2514) and worked (6803).

Portugal

General

In the middle of the 19th century, quarrying in Portugal developed to supply slate exports to England and the US. Domestic use is now around 22,000 tonnes annually,[1] most of which is supplied by domestic production. Since the 1950's there has been some production of large slabs and domestic consumption now covers the full range of applications.

Exports

Portugal exports around 10,000 tonnes a year, mainly to West Germany (2,500 tonnes), Belgium/Luxembourg (2,000 tonnes), the Netherlands (1,300 tonnes) and Denmark (1,300 tonnes). Minor export destinations are detailed in Appendix N. The slate is suitable for roofing, cladding and flooring applications, in addition to the use as billiard slate mentioned above. Quality is generally regarded by importers in the US as very poor for outdoor use.

Import Market

The country imports less than 400 tonnes a year; rough, unworked slate from France, roofing and cladding from West Germany, miscellaneous articles of slate from the UK and worked billiards blocks from Spain. Spanish slate is

generally hard and does not work well. It is possible that billiard table slate originates in Portugal and is worked in Spain for re-export back to Portugal.[2]

Not all the countries mentioned above export slate to Portugal each year as shown in Table 37.

Table 37: Portuguese Slate Imports
(tonnes per annum)

	1980	1981	1982	1983	1984	1985	
France	72	140	360	-	190	330	
Spain	24	-	-	-	-	-	
FRG	-	-	-	9	-	-	
UK	neg	-	6	-	-	neg	
Other	-	-	-	48	-	-	
Totals	96	140	370	57	190	33	0

Source: Official Portuguese government statistics
Neg: Negligible

As an import market, Portugal is small, but niches may exist on a special order basis, possibly through architects' specifications.

Footnotes - Portugal

[1]Production, according to official Portuguese government statistics has averaged 31,600 tonnes annually over the last seven years. Robbins, in Industrial Minerals, May 1986 quotes annual production of 40,000 tonnes, probably because of higher than average production (45,000 tonnes) in 1984. Average exports are 10,000 tonnes a year and imports, 400 tonnes.

[2]Information from a Spanish trading agent.

Scandinavia

Scandinavia, comprising Norway, Sweden, Denmark and Finland, consumes an estimated 20,000 tonnes of slate per annum. Production is concentrated in Norway which, at a consumption of around 10,000 tonnes per year, is a major producer and the largest user of the four.

General

An area where a variety of natural stones have been mined and quarried over a period of years, Norway is known as the source of many decorative architectural stones. Within the country itself, the largest use of slate is flooring, with about 75 per cent of the slate used being in the form of interior tiles or exterior paving. Architectural uses account for around 15 per cent and the balance of 10 per cent is used for roofing applications.

Norwegian slate would appear to be particularly suitable for the manufacture of large pieces for use as window sills, stair treads and wall cladding. At 15 per cent of the total market for slate, the architectural segment is relatively more important than in most other slate-using countries. It is likely that Norwegian exports also include a higher proportion than average of slate suitable for architectural uses.

Norwegian slates are grey, rust and black. The black

slate is very hard and even the natural cleavage looks polished. The slate production industry in Norway includes two companies, Paul Eida and Norsk Cement, which mine a range of other dimension stones in addition to slate.

Consumption

In 1985, Norway exported 25,000 tonnes of slate and imported 1,700 tonnes.[1] The consultants have estimated production that year from a combination of the largest quarry's production[2] and estimated tonnages from other quarries, giving a figure of 33,000 tonnes. This places consumption at around 10,000 tonnes.

Norway's imports of slate derive mainly from Sweden (1,000 tonnes) then Italy (300 tonnes) with small quantities in some years coming from East or West Germany.

Price

In 1985, exports from Norway were fetching an average of C$160 per tonne for rough slate and C$401 per tonne for slate products (export values). This contrasts with the more expensive items which Norway imported that year at C$182 for rough slate and C$616 for products. A breakdown of these weighted average values is shown in Table 38.

Table 38: 1985 Norwegian Slate Trade Values
(C$ per tonne)

	Exports		Imports*	
	2514	6803	2514	6803
Switzerland		900		
Italy		800	390	
Belgium/Lux	200	570		
W. Germany	200	540		1,000
Finland	120	480		
Denmark	140	450		
Netherlands	120	380		
Sweden	110		80	400
E. Germany			480	
Other	490	630	720	440
Weighted Averages	140	400	180	620
Total Tonnes	14,000	11,000	1,500	300

Source: Official Norwegian government statistics
* Customs values

The bulk of the total of 25,000 tonnes of slate exported in 1985 was sold at the lower end of the price ranges. 15,000 tonnes was destined for the Netherlands and 5,000 tonnes for Denmark. Within the range of products imported there appeared to be niches for higher priced slate, such as the 83 tonnes from West Germany.

Footnotes - Scandinavia

[1]Trade figures from official Norwegian government statistics

[2]Alta Skiferbrudd produces 400,000 sq m (approximately 11,000 tonnes) of slate per year, (Industrial Minerals, May 1986).

Switzerland

Switzerland is an example of a minor market which imports small quantities of slate from a variety of countries. Some 2,100 tonnes is used annually for flooring applications, using larger sized tiles of an area of between 1 and 2.5 sq m. The roofing segment of the market is very small at around 250 tonnes per year. The remaining segment of the market is the hundred or so tonnes imported each year for use as writing surfaces. Domestic production and exports of slate are very small.

General

85 per cent of the slate used in Switzerland is for flooring applications. According to one trader, slate accounts for 30 per cent of the natural stone flooring market (3 per cent of the total flooring market) and the use of natural stone floorings is on the increase because of the trend towards under-floor heating. 50 per cent of the slate flooring used is in residential situations, 20 per cent in schools and 30 per cent in other public buildings.

The remaining 15 per cent is roofing slate for the residential sector (10 per cent) and writing surfaces (5 per cent).

Swiss industries typically consist of many small firms and the slate industry is no exception. There are at least

five processors/manufacturers of writing slates, five general manufacturers and two companies described as being involved in the treatment of natural stones. Supplies are obtained through six wholesalers.

Consumption

Switzerland has had no serious production of slate for the last 50 years and exports are very small. Consumption is equivalent to imports at a level of 2,500 tonnes per annum,[1] valued at C$1,500,000.[2]

Switzerland draws on many countries for her small supply of slate. Over the past five years Italy, France, West Germany and Spain have been the major suppliers, with quantities of under a hundred tonnes being obtained on occasion from such countries as China, India, Belgium/Luxembourg and the Netherlands.

Product Characteristic Preferences

The Swiss show a preference for larger tiles in both the flooring and roofing market segments.[3] Roofing tiles are generally 20 x 30cm or 30 x 30cm and 5-8mm thick. Some may be as thick as 12mm depending on the type of slate and how it cleaves. Tiles are never smaller than 20 x 20cm. Pointed or rounded "beavertail" or "flake" tiles, usually associated with West Germany, are also popular in some areas of Switzerland.

Floor tiles are seldom smaller than 20 x 25cm. They are more often 30 x 60cm, 40 x 40cm, 50 x 50cm or 40 x 60 cm. A random length selection with a width of 25, 30, 35 or 40cm is popular. These tiles, all for interior use, are sold in several thickness ranges, for instance, 10-15mm or 10-20mm thick but not less than 10mm. They are generally ungauged and laid in mortar. Exterior flagstones of 30 x 50cm, laid in sand, are used in gardens.

Writing slates and blackboards for schools are manufactured from black slate with a smooth surface suitable for writing.

Price

The weighted average value of slate imports in 1985 was C$450 per ton. Rough slate (2514) ranged in price from C$81 (FRG) to C$828 (Norway).[4] French and Italian rough slate were valued at C$93 and C$203 respectively. The average value of worked articles of slate (6803) was C$620 (all customs values per tonne).

Footnotes - Switzerland

[1]Official Swiss government figures are 1,230 tonnes (1984), 2,530 tonnes (1985) and 2,668 tonnes (1986).

[2]Based on the 1986 weighted average import value per ton.

[3]Sizing information from Eckardt Natursteine

[4]This value appears high for rough slate and the commodities are registered by Norway as worked slate in category 6803 (p 138).

Australia

Australia's use of slate, mainly flooring, has been growing over the last few years. In 1984/85[1] the country produced 12,000 tonnes of slate, imported 34,000 tonnes and exported very small quantities[2], giving a consumption figure of 46,000 tonnes. This dropped to 42,000 tonnes in 1985/86, which is still a significant increase from the 1981/82 figure of 19,000 tonnes.

General

Historically, roofing was the main use for slate in Australia. The Welsh slate which went there as ballast in convict ships was utilized on local roofs. Native Australian slate has been described as too porous to weather well in roofing applications. This was borne out by the major importer who reported that European slate is used for this market segment. An exception is the production in Victoria of around 700 tonnes of roofing slate per annum.

Today, roofing accounts for only 5 per cent of total slate usage. Slate roofs are seen as an expensive option in both the public and residential markets in which a new slate roof is only feasible for a small number of houses in the C$300,000 plus bracket.

A small but thriving restoration market exists which aims to keep refurbishment as authentic as possible. The

Heritage Council insists that newly quarried Welsh Penrhyn slates are used to replace the originals.

A more encouraging picture emerges in respect of flooring applications. The sawn-edged flooring market has grown over the last four years to its present level of around one million sq m per year, about 95 per cent of total slate usage. Northern Australia experiences high temperatures year-round and much of the south has hot summers. As in the Mediterranean countries, the concept of cool flooring materials is attractive and slate is increasingly being accepted as an alternative to other hard floorings, especially in New South Wales which uses 40 per cent of Australia's imported slate.[3] Many colours of slate are imported from all over the world for flooring use, largely in the private residential sector.

If native Australian slate is too porous for serious roofing applications, it is judged suitable for many of the rougher landscaping applications. About half of New South Wales' production is used for garden paths, patios, steps etc. and the low price commanded makes it a feasible proposition for a life span of say ten to twenty years.

The architectural market segment which is of recent origin is estimated to be around 1-2 per cent of the slate market and is supplied by imports.

Consumption

Imports have grown from 330 thousand sq m in 1981/82,

to 1.2 million sq m in 1984/85, falling to 1.1 million sq m in 1985/86, a net increase of 60 per cent over the four years. The recent decrease reflects a reduction of housing starts in 1985/86. Tonnage calculations are dependent on the thickness assumed for the tiles. On the basis of 10mm average tile thickness,[4] 1985/86 Australian imports were 31,000 tonnes and annual consumption of slate can be placed at around 42,000 tonnes.

Production and Trade

Australian production remained steady over the period 1982 to 1986 at around 10 - 11 thousand tonnes each year. From 1981 to 1986 South Australian production increased from 6,500 to 9,700 tonnes. The outputs of both Victoria and New South Wales decreased over the same period; Victoria from 1,600 to 700 tonnes and New South Wales from 1,900 to 440 tonnes.

One major importer based in New South Wales estimates that the company controls 85 per cent of the market. They import direct by container ship to Sydney, from whence their own fleet of transport trucks picks up the slate from the docks and moves it to their distribution centres throughout Australia.

A small quantity of exports of New South Wales slate is also handled by this company. Destinations include Vanuatu, New Caledonia and Papua New Guinea. The slate is purchased

from the local quarries and trucked by the company to the Sydney docks.

Table 39: Australian Imports (tonnes)*

	81/82	82/83	83/84	84/85	85/86
India	3,800	8,600	10,000	17,000	13,000
South Africa	3,600	5,600	5,800	9,800	9,300
China	1,400	4,500	6,300	6,300	8,700
Italy	430	200	140	310	130
UK		52	86	12	320
Other**	14	130	66	100	180
TOTALS***	9,300	19,000	23,000	34,000	31,000

Source: Australian Board of Statistics.

* Tonnages derived from sq m figures using a conversion factor of 36 sq m per ton at 10mm thick.
** Other includes Hong Kong, Switzerland, Mozambique, Portugal, Korea and Zimbabwe.
*** Discrepancies due to rounding.

Tonnages imported have more than trebled during the period 1981/1982 to 1985/86. The increases have largely been in slate imported from India, South Africa and China. The minor tonneges of slate imported from Italy decreased over the same period and those from the UK increased (Table 39).

No Spanish imports during the fiscal years from 1980 to 1986 are detailed in the Australian Board of Statistics

whereas the official Spanish government trade figures for the calendar years 1980 to 1985 list annual slate exports to Australia of between 160 and 610 tonnes. Discrepancies also exist between Australian and Indian statistics of Indian exports to Australia (p 149).

Product Characteristic Preferences

The whole available range of colours of slate flooring tiles would appear to be used in Australia and no distinct preference has been identified. Welsh blue has a monopoly in the historical building restoration market. The native green, purple and grey from South Australia and New South Wales is used for flooring and landscaping applications.

Flooring tiles are generally 10 - 15mm thick. The most popular size of roofing slate is 50 x 25cm.

The official position is that there are no national standards or technical rules governing the import, export or use of slate in Australia.[6] This was confirmed by the major supplier who does not work to any formal national standards.

Price

Over the years 1983/84 to 1985/86 the most expensive slate imported by Australia came from the UK, at a customs value of between C$10 and C$35 per sq m. South African slate was next in the range at C$8-12. Slate from India, China and Italy ranged around C$6, and amongst the minor suppliers, there was a variety of import values from C$3

(France) to C$70 (Netherlands) [all values per sq m]. Table 40 shows values per tonne of slate from the major source countries.

Table 40: Average Australian Import Values
(C$ per tonne[1])

	1983/84*	1984/85**	1985/86***
UK	460	1,200	400
South Africa	420	320	300
Italy	190	210	260
China	210	190	230
India	220	200	210

Source: Australian Board of Statistics
* Using 1984 average C$ exchange rate

** Using 1985 average C$ exchange rate
*** Using 1986 average C$ exchange rate
[1]Tonnes derived from sq m figures - see Table 39.

India, South Africa and China supply slate to Australia at the lower priced end of the market. Whether prices have influenced the levelling out of the pre-1985 growth trend is not clear. Nevertheless, these three countries have become well established as the major suppliers of the Australian market over the last five years.

Footnotes - Australia

[1]Victoria and New South Wales provided production data on a fiscal year basis. South Australian production figures (calendar year basis) have been allocated to the fiscal year which commenced in the previous year, e.g. 1982 South Australian production added to 1981/82 figures.
[2]Canadian Embassy, Canberra
[3]Industrial Minerals, May 1986.
[4]Private communication with a supplier.
[5]Industrial Minerals, May 1986.
[6]Canadian Embassy, Canberra.

India

India's role in the world slate trade is that of a minor producer and exporter. There is no indication that India imports slate or that dimension slate is used within the country to any great extent. Slate waste products appear to be produced in quantities of up to a million tonnes annually and the majority of these are used locally as components in domestic cements and aggregates.

General

Despite a history of dimension stone usage, in which marble and other stones have been used for roofing and flooring over a period of years, India has increasingly followed the trend towards using concrete and other man-made construction materials. In many areas roofs are now flat. Where tiles are used, they are generally made of clay and slate roofs are rare, even on public buildings.

Slate is produced in India by several large stone producers (who also produce and export a range of products other than slate) and by a number of smaller companies, some of which are listed in Appendix J-1.

Consumption

The official Indian statistics[1] show annual exports of between 6,100 and 12,000 tonnes from 1980 to 1985 and pro-

duction ranging from 15,000 tonnes in 1980 to 6,500 tonnes in 1986. The official tonnages are as follows:

Table 41: Indian Production and Exports
(tonnes)

	1980	1981	1982	1983	1984	1985	1986
Production	15,000	13,000	6,800	6,000	7,700	8,600	6,500
Exports*			6,100	8,400	7,900	10,000	12,000

Source: Indian Bureau of Mines
*Fiscal year figures 1980/81 to 1984/85.

Production would appear to be decreasing and exports increasing, which in itself is unlikely. In addition, the export figures which appear in the Indian government statistics are much lower than those quoted by destination countries as imports. A notable example is Australia, where 17,000 tonnes (see note to Table 39) was recorded as being imported from India in 1984/85 as opposed to the 9,900 tonnes indicated by India as exports to Australia over the same period. Either imports recorded by destination countries include some slate waste products or India is a much larger producer and exporter of slate than indicated by the official Indian statistics.

A further set of production statistics is available, however, the scale of which indicates that it includes rough slate.[2] Tonneges are as follows:

1983	1984	1985
420,000	520,000	1,100,000

Whichever explanation for the discrepancies noted above is correct, Indian consumption of dimension slate for construction applications is quite low; probably not more than one or two thousand tonnes per annum. It can be assumed that the powders and granules produced are largely used locally as a component in building materials, some of which may be exported.

Price and Product Characteristics

Australian import data values Indian slate at C$6 per sq m, (significantly lower than that imported by the Netherlands at C$40). US customs value for Indian roofing slate was C$17 per sq m in 1985.[3]

Among the colours included in India's slate product range are green and "brown" (a mottled red). Larger sizes of flooring and roofing tiles, such as 40 x 40cm and 50 x 60cm, were mentioned among exports to the Netherlands and Australia. Robbins includes the smaller sizes of 30 x 30cm and 30 x 50cm in her description of roofing tiles produced by the state-owned Rajasthan Slate Mineral Development Corp. Ltd.[4]

India is a country which produces a range of aesthetically appealing stone products and slate is one of these for which the largest customer is Australia. Due to the conflicting statistics available, export trends are obscure and future development of trading patterns, hard to predict.

Footnotes - India

[1]Statistics obtained by the Canadian High Commission, New Delhi, from the Indian Bureau of Mines.

[2]Slate as a minor mineral, Indian Bureau of Mines statistics.

[3]Derived from US Department of Commerce Statistics.

[4]Industrial Minerals, May 1986.

China and Hong Kong

Official Chinese statistics of slate production and trade were not available. Traders from the UK and US have indicated that the country has large deposits of slate of variable quality. A recent entrant to the slate trade, China offers her product at the lower end of the price range. Imports to Hong Kong are comprised largely of slate with writing surfaces in addition to small quantities of rough slate. Australia, the Netherlands and the US import Chinese slate for flooring applications.

Hong Kong produces no slate. As a free port it is used for trading by China whose slate products are handled by a Chinese government agency based in Hong Kong. The slate is transported from China to Hong Kong by ship, barge or train and normally re-exported by ship. According to the statistics received from Hong Kong,[1] trade with China is growing.

Table 42: Hong Kong Slate Trade
(tonnes)

	1983	1984	1985	1986	1987*
Imports**	900	1,600	1,700	2,300	3,500
Re-exports	400	500	300	500	1,400
Exports	200	400	500	700	1,500

Source: Hong Kong Trade Development Council
* Nov-Jan
**China is the main supplier and it is estimated that 60 per cent of imports originate there.

Note: Tonnages are based on rough slate (tonnes) and writing slates and boards (pieces). Pieces exported were converted to tonnes on the basis of an average size of 1 sq ft, 1/4in thick. In the absence of data, the internal consumption of writing slate has been ignored.

All exports from Hong Kong are categorized as slates and boards with writing surfaces (895920). These materials appear as import category 9806, for instance, into West Germany. Statistics were not pursued for writing-slate importing countries.

The import statistics from the countries which list imports from China, give the following picture:

Table 43: Recorded Imports from China
(tonnes)

	1982	1983	1984	1985	1986
Australia	1,400	4,500	6,300	6,300	8,700
Hong Kong	n/a	500	1,000	1,000	1,400
US*	-	-	345	956	1,348
Netherlands	n/a	n/a	n/a	n/a	2,100
Japan	n/a	n/a	n/a	n/a	130
Belgium/Lux	56	-	170	74	77
UK	n/a	n/a	60	32	37
Switzerland	-	43	49	-	-

Source: Importing countries official government statistics.
*On the basis of US$ figures at an average 1986 customs value of US$409 per tonne of roofing slate and US$371 per tonne of slate and slate articles other than roofing. Figures for 1984 and 1985 are based on 1986 customs values per tonne and total import values in current US$ (Appendix R).

China's recent encouragement of the escalation of trade between China and the rest of the world, indicates that more will be seen of low-priced Chinese slate products in an increasing number of countries. Should an acceptable track record be established for higher-priced items, these too could become significant competition under an aggressive marketing strategy.

Footnotes - China and Hong Kong

[1]Hong Kong data from the Commission for Canada, Hong Kong.

Japan and the Far East

The major slate-producing countries supply small quantities to the Far East. Examples are a much publicized contract done by Burlington Slate in China,[1] and a recent contract by Vermont Structural Slate Co. in Japan.[2] In addition, some minor slate exports within the area have been identified from China, Hong Kong and Korea. No information was available on Chinese exports to countries in the Far East other than Japan and Hong Kong. Although Japan, with a consumption of 2,000 tonnes a year,[3] appears to be the most active user of slate in the area, other countries may import small amounts from China. Slate is not a traditional building material in the East and the lack of affluence makes the mass use of an expensive material, such as slate, unlikely.

Old-style Japanese buildings were built of wood and had traditional pitched roofs covered with wooden tiles or circular grey ceramic tiles. The latter are still used where the expense can be tolerated, as the Japanese have conservative tastes and often choose sombre colours such as grey and black. Economic considerations usually lead to new pitched roofs being covered with bright red or blue tiles in man-made materials which are copies of ceramic tiles previously used. These types of roofing materials are used mainly on prestige residential properties. Office and apart-

ment blocks and commercial developments are often built of modern materials, such as reinforced concrete, with the associated flat concrete roofs.

The Japanese market for slate in small and very specialized. Colours are carefully chosen and sometimes unusual, such as brown. As elsewhere, fashion in Japan carries a certain unpredictability, but tastes change more slowly and an escalation in the use of slate is not foreseen.

Footnotes - Japan

[1] In May 1985, polished slate flooring valued at £120,000 was ordered from Burlington for the Zhumchen Museum in China (Industrial Minerals, July 1985).

[2] Private Communication

[3] Quantities estimated from Japanese government monthly statistics.

South Africa

South Africa was included in the survey as a significant producer and supplier, especially to Australia, the Far East and some European countries. Since 1980, around 45,000 tonnes of slate has been produced annually in South Africa, of which between 8 and 17 thousand tonnes was exported. There are two major producing companies and over twenty smaller ones.

Production

South Africa produces high quality slate for both the domestic and export markets. Products for export are increasingly shaped and finished within South Africa with floor tiles accounting for 85 per cent of exports.

Production tonnages from the South African, Minerals Bureau of Statistics[1] are as follows:

1980	1981	1982	1983	1984
52,000	57,000	44,000	40,000	45,000

Production fluctuates around 50,000 tonnes annually and there is no obvious recent increasing or decreasing trend.

Exporting Activity

Exports prepared in a range of sizes and thicknesses to

suit their destination markets, increased from 11,300 tonnes in 1980 to 17,400 tonnes in 1985[2] as follows:

1980	1981	1982	1983	1984	1985
11,300	11,000	9,600	8,100	13,600	17,400

Despite the decreasing trend in the early 1980's, exports rose to higher levels in 1984 and 1985. According to statistics from destination countries, Australia imported 9,800 tonnes in the fiscal year 1984/85, Belgium/Luxembourg imported 500 tonnes in 1985 and the Netherlands imported 950 tonnes in 1986. Other principal destinations are the US, France, Italy and the Far East, including Japan.[3]

It remains to be seen whether the recent move towards trade sanctions renders South Africa less of a competitive force to be reckoned with, especially in Australia, where 30 per cent of slate imports in 1984/85 originated in South Africa.

Footnotes - South Africa

[1] Industrial Minerals, May 1986

[2] South African government export statistics.

[3] South Africa export market information from the Canadian Embassy, Pretoria, except for the US, which imported 400 tonnes from South Africa in 1985 (derived from official US Government statistics at a customs value of US$580 per tonne.)

South America

The economies of South America cannot support the import of large quantities of slate. Neither are existing deposits currently being exploited on any large scale for sale on the world market. Some slate is produced and exported by Brazil and small imports are recorded from Spain to a number of South American countries.

Production

Slate deposits exist in South America but little mining for export on the global market has been carried out. No imports or exports of slate have been recorded by Venezuela during the last ten years although many slate deposits were identified during the Ministry of Mines last survey of slate in 1954.[1] Family-owned mines have in the past been supplying slate locally for use as blackboards. These are now being displaced by magnetic boards.

Brazilian reserves of slate are estimated at 28.8 million tonnes.[2] Official Brazilian government statistics show production tonnages as follows:

1981	1982	1983	1984	1985	1986
19,000	4,400	98,000	61,000	46,000	120,000

No doubt most of this is non-dimension slate.

Exports

Brazil exports slate and, according to the official statistics, both the number of destination countries and the small quantities exported have been growing. In 1984, four tonnes was recorded as being exported to the Netherlands at an export value of C$1,300. The figures for 1985 and 1986 are as follows:

Table 44: Brazilian Exports

	1985		1986	
	tonnes	C$	tonnes	C$
USA	63	13,000	54	16,000
Belgium	19	5,500	31	8,000
Bolivia	18	410	25	2,200
Paraguay			23	8,700
Puerto Rico			17	9,000
Total	84	19,000	150	44,000

The Brazilian 1985 export value of C$13,000 to the US should, however, be compared with the US import values for slate from Brazil of up to C$470,000 over the past several years. These figures represent exports in the order of 1,000 to 1,500 tonnes per annum and therefore seem more commensurate with the production figures. If this is so, Brazil is thereby an established minor exporter of dimension slate, positioned to be a growing low cost producer for the US market.

Imports

Spain's exports to South America total up to 800 tonnes[3] a year, the majority of this being imported by Argentina. Chile, Uraguay, Venezuela, Brazil and Peru have imported small quantities on occasion. Bolivia and Paraguay have recently imported small quantities from Brazil.

Footnotes - South America

[1]Canadian Embassy, Caracas

[2]Source: Canadian Embassy, Brasilia

[3]Official Spanish Government Statistics

USSR and the Eastern Bloc

Eastern Europe is less active in slate usage than Western Europe. Yugoslavia produces a negligible amount (three tonnes was imported by Belgium/Luxembourg from Yugoslavia in 1985).[1] Western Poland did mine slate some 40 years ago but the quarries have since been abandoned. Slate has been supplanted by tile apart from minor historical restoration work.[2]

The USSR produces 211 million cement roofing tiles each year in which slate powder may be incorporated. Of these, 22 million tiles are exported to Hungary and 5 million to Cuba. The USSR does not import slate.[3]

No other evidence of trade with the Eastern Bloc countries has emerged during the study.

Footnotes - USSR and the Eastern Bloc

[1]Canadian Embassy, Belgrade
[2]Canadian Embassy, Warsaw
[3]Canadian Embassy, Moscow

POTENTIAL MARKETS FOR NEWFOUNDLAND SLATE

Overview

The production and trade statistics from around the world show that the overall demand for slate in the 1980's has grown moderately but has taken a more marked upward trend in certain countries. (Table 3). Stone dealers comment that the most sought after slates are subject to very long delivery schedules. The current Newfoundland producers have found that the Vermont-New York quarries and the central Canadian dealers constitute a market for their products at present. Some quarries and many dealers in different countries have expressed interest in the possibility of Newfoundland slate supplies.

The slate market can be regarded as consisting of two parts. The first and major part of the market is a commodity market in which products are traded readily around the world and in which products from the low cost producing countries tend to set a price regime in which newcomers such as Newfoundland must compete.

Although product characteristics such as colour are important within that regime of price, technical specifications are not strict and quality is variable. The short-run prospects for Newfoundland slate in this market depend on whether an acceptable product can be landed at specific points to compete with a comparable quality of

slate from for example Spain, Brazil, South Africa, Italy and China.

The second part of the market comprises products for which there is a very specific demand:

. by virtue of traditional allegiance to a source and the proven life-span of the products (e.g. Welsh roofing slate).

. by virtue of specific characteristics of the stone for example:

  - the black and grey slates of Pennsylvania and Virginia, available in large sizes and with specific physical properties;
  - Italian (and at a lower quality level, Portuguese slate) for billiard table tops for easy machining qualities and large sizes;
  - the green volcanic tuff slate of the English Lake District, extremely hard and non-porous, and available in relatively large sizes and thin slabs;
  - the small-volume specialty colours produced in localized areas, such as Indian red/brown; California and Arizona black slate; marbled Spanish and Italian green; and so on.

. by virtue of specialized manufacturing methods used by suppliers of the stone to produce shapes and finishes

for specific end-uses. Italian billiard tables and architectural shapes from English Lake District producers are examples.

In these specialized markets, price can be a secondary consideration within limits, although in the long run, high prices attract innovation from competitors, and cause price erosion. Technical sales service and highly individual promotion are important. Installation and performance criteria can be demanding and reputations broken on the basis of a major contract badly done.

Competition

The world's slate producers possess various advantages with which a small Canadian producer must compete.

Scale

The size of the Penrhyn operations, for example, and the large Spanish quarries, allows economies of scale and a degree of strength in the marketplace against process and product developments can be financed and pursued.

Size of Stone Blocks

The nature of the stone deposits at the Virginia quarries, the Welsh and the Italian quarries, for example, allows the extraction of large blocks either by blasting or by sawing blocks directly from the deposit. The dimensions possible for the final products are advantageous and the

extent of wastage reduced.

Physical Properties

Straightness and fineness of grain; thickness of roof tile; workability; absence of warp; low water-absorption: all are prized for various applications and all exhibited in high degree by one type of slate or another from around the world.

Colour Range

Architects and designers are very specific in matching colour to concept and design. There are said to be fifteen different greens available in slate, for example, each of which can satisfy an individual preference. Overall fashion trends, such as a current preference North America for light colours in interior decors can influence choice.

Labour Costs

Many producing countries including Spain, Portugal, South Africa, the less developed countries, the recent entrant China, and to a certain extent Vermont - have the competitive advantage of labour costs which are lower than those in Canada.

Labour Skills

Many established slate quarrying areas have a tradition of employment and family involvement in the industry and in some cases the skilled labour pool is kept intact as far as possible during temporary downturns in business.

Capitalization and Mechanization

Quarries in West Germany, the UK, Spain and the US have been reported in the trade literature, as having undertaken both comprehensive mechanization and upgrading of the quarry layout. Persistent attention to technical development and optimization of access to the stone deposit are important for long-term cost reduction and each demands significant investment.

Promotion

Promotion takes several forms, not always obvious. It takes place through the establishment of producers' reputations and the operation of the industry network at the board level; through the promotion of contract slate business to architects by building relationships over time; and by the gradual establishment of the producer's reputation. Floor tile dealers will undertake regular programs of calls upon architects, in which slate and other floor tile materials are promoted together. Increasingly, also, producers and importers are using more sophisticated advertisements in trade journals and brochures, putting higher emphasis on coverage in these and in such publications as Sweet's catalogue. Major producers (and also some lesser participants such as the Indian industry) are putting strong emphasis on promotion by a combination of these various approaches.

Interestingly, not all producers promote overtly; in fact, quite the reverse is true. Certain major established companies purposefully eschew publicity on the grounds that it draws the attention of competitive entreprises.

Location

Newfoundland industry must first contend with the paucity of local markets. To a greater or lesser degree all the US and European/UK producers have the advantage of an appreciable local market base, for both high value products and low, within a radius of up to a few hundred miles.

Newfoundland's Competitive Position

Against these established advantages what potential cards does the Newfoundland industry hold?

Good Quality Stone

There is a great deal of poor quality slate being sold. In certain cases it is simply a mismatch between the material and its function, in others, quality is variable within and between lots. The black slate from Italy will whiten or weather to silver-grey in outdoor exposure; certain Spanish and Chinese slates will spall in acidic atmospheres and in freeze-thaw conditions; Portuguese slate crumbles; Portuguese spandrels warped on a major commercial building job; and so on. Purchasers choosing from the wide

range of slate products being traded are therefore open to the dangers of variable quality.

The slate business generally works not on specifications but on reputation and prior experience, advance samples and subjective criteria.

The cleft face exhibited by the Nut Cove slate for example, does not have the fine, linear grain preferred in the best roofing slates in Europe. Though it is doubtful that this constitutes a functional disadvantage, it will tell in certain markets. Again, hardness, insofar as it affects workability, is an important factor in the gauging process. Stone varies from point to point within the quarry and some measure of uniformity may be a future selling point. Process operators currently judge this quality by experience and reject sub-standard slate accordingly.

Pyrites cause serious damage to diamond cutting blades and diamond gauging stones. In roofing, pyrite and calcite inclusion lead to iron staining and physical deterioration of the slate, respectively. In floor tile, inclusions represent visible impurities to the consumer. The pyrite and calcite inclusions in the current Newfoundland production are apparently sparse enough to be controlled economically by visual inspection of the outgoing products.

Newfoundland slate has the advantage of being able to

show a one hundred year track record of stable colour and physical integrity. Provided that consistency in quality management can be maintained, this is a feature that can be promoted.

Delivery schedules are an important competitive factor in the slate market, particularly for the less specialized contracts where other materials are optional. The lead time on deliveries to Canada from the US has been decreasing during late 1987.

Colour

The two major colours currently produced in Newfoundland are not unique, but in the course of this survey, traders in various countries expressed their interest in the product. The following are points made by various industry members.

1. The green slate is non-fading. Although there is a part of the Eastern US market which prefers the appearance given to a roof over time by the partial change from green to beige, non-fading green is at a premium and is in relatively short supply.

This characteristic is presumably important in the case of outdoor paving applications also, though the bulk of Canadian sales are likely to be for indoor installation. Opinions vary concerning the desirability of the rather greyed olive-green, which constitutes most of the Nut Cove

green. Some suggest that it is not green enough for today's indoor decor; others suggest that it fits the present vogue for grey. The lighter blue-green which is present in much smaller amounts, is unusual in the trade. Few floor tile materials are available at the blue end of the scale, and a market for this material could be developed if quantities suffice.

2. Purple slate is not a high volume colour nor a premium priced colour. It seems to be a less well-known product which has the value of giving some distinctive qualities to a building on which it is used as roofing. Although dark colours tend not be in favour, there is a current vogue in the US, of greys for interiors, often combined with colours in the burgundy-purple range, which suggests that the Newfoundland purple should be promotable on that account, rather than in mixed-colour patterns.

3. Red slate is scarce and commands a premium price. The trade finds that red slate in reasonably large sizes (say a minimum dimension of 12in) is hard to come by. Red quarry tile from Italy and Spain, against which red slate often competes, is increasingly expensive and less available. Conversely, there is not the breadth of market that there is for the more muted green and grey. The same comments apply to red slate for roofing (see also p.31). Depending upon the characteristics of the red slate deposits and the economics of quarrying, the market opportunities

should be explored.

Tidewater Location:

The location of the Nut Cove quarry offers the potential of low-cost bulk transportation should conditions arise where that would be beneficial. The current lack of both road access to the site and docking facilities renders the location disadvantageous as far as outward shipments of slate are concerned. Waste rock disposal is simplified, however.

Labour

One more advantage that has been cited by observers in other Canadian and US locations is the existence of a potentially stable labour force which can be relied upon, as training progresses, to provide continuity of effort and experience.

Product and Market Considerations

Roofing

In the medium term, the Eastern US market will apparently absorb the likely production of Newfoundland green slate. The degree to which Newfoundland purple roofing slate would sell in this market, if further promoted, is uncertain as the usually accepted colour range consists of blue-black, grey and green. Although the colour is close to that of the

burgundy Vermont slate, the prospects should be examined.

Looking further afield, because a colour such as green has little history of usage in many countries, it is hard to predict to what degree a latent demand exists and market development would have to be undertaken. Dealers in France and the UK have expressed a positive interest in both green and purple.

A traditional usage, whether of native or imported slates, seems to perpetuate a limited choice of colour. One dealer stated that the West Germans would look at nothing tut blue-grey. The majority of French roofing slates, which originate in Spain, France and the Ardennes, are black and, grey with some purple. Likewise in Belgium, where black slate is imported from Spain for roofing.

Green slate as a roofing tile has some degree of market share in certain regions of the UK. The green which serves this market is Lake District stone which is of a characteristic texture and realizes more than twice the price of regular grey and heather-blue slates. The question of a potential market for regular green slate therefore merits some investigation. It should be recognized that the Penrhyn quarry contains green, purple and red slate, and the green at least has been used to produce both architectural/ flooring slate and granules. Penrhyn's practice however, is to avoid producing minority, low-volume colours in roofing slate.

Weathering ability is a prime consideration with regard to roofing slate quality. Wetting/drying and acid resistance tests are published under ASTM and BSI standards. In addition, German DIN standards include a freeze/thaw test. These tests are indications of how well a particular piece of slate will weather. Newfoundland slate should perform well in this respect and this may prove a selling point against Spanish and Chinese slate in cold-climate markets and those where atmospheric pollution is a major consideration.

The thickness of roofing slate is a characteristic preference of the different markets. Taking France as an example, imported roofing tiles are 5mm thick (from the UK); more generally 3.5mm thick (Spain); and the native French product (2.7mm). The thickness achievable with Newfoundland slate may therefore be a constraint in some markets. They correspond roughly to the UK "heavies".

The size of roofing slates is all-important. The ability to supply a high percentage of large sizes or to ship selected sizes is a controlling factor in extending markets and increasing returns to the producer (Appendix V). The UK market is likely to be particularly demanding in this respect.

Flooring

As with roofing slates, the larger floor tiles are more difficult to obtain and many traders interviewed during the

survey referred first to size. Larger tiles are preferred in much of Europe, notably the Netherlands, Belgium and Switzerland. Sizes quoted by Dutch traders were 40 x 40cm and 40 x 40cm, 30 x 60cm as well as 15 x 30cm. These tiles are 10 - 25mm thick and often ungauged, thus requiring a reasonably smooth cleavage and uniform thickness. Dealers in Belgium expressed similar preferences, quoting 40 x 40cm and 30 x 60cm tiles 10mm thick. In Switzerland, a larger range of sizes was quoted comprising 30 x 30cm, 40 x 60cm, 40 x 40cm and 50 x 50cm. Tiles sized 20 x 25cm were also mentioned briefly as a poor substitute. "Random" lengths in 25, 30, 35 or 40cm widths are also used. Thickness varies from 10 to 20mm for internal use and 30 to 50mm for exterior paving slabs. As in the Netherlands, tiles are often ungauged and laid in mortar (interior) or sand (exterior). It was expected that tiles thicker than 20mm would generally be uneconomical to transport from Newfoundland.

Canadian flooring slate processer-dealers buy both gauged and ungauged tile. There is comparatively little resale of ungauged tile, most flooring business being for "thin set" application on a subfloor or level concrete surface. The quality of ungauged tile and cutting stock with respect to hardness/softness and the uniformity of thickness must be such as to allow economical gauging. A common problem to the processor is that ungauged tiles are supplied in widely varying thickness, which can lead to waste factors of up to

25 per cent.

An additional consideration is that there are potential problems in tile plants with the management of effluents, with the percentage of waste in the gauging process and with labour supply. The purchase of ready gauged tile is therefore attractive in principle but dependent on price in the final analysis. Price and the ability to dispose of edgings (e.g. for house veneer) also determine whether a plant buys cutting stock or sawn tiles.

In the US the slate floor tile market standard is 12 x 12in, and slate flooring is commonly sold in boxes of ten 12in tiles. Boxed mixed sizes are sold in multiples of 3in or 6in dimensions as pre-packed colour mixtures which are designed to produce a standard 10 square foot floor-pattern. The pre-pack business flows through building supply stores to the householder and small contractor market and constitutes about 10 per cent of the indoor slate flooring market in Canada. some commentators put it much higher than that in the US.

Whereas the traditional roofing markets tend to adhere to the traditionally used colours, a wider range tends to be acceptable or sought after for flooring applications. Interest in both green and purple slate has been expressed by dealers in the US, the UK, Europe and Australia. Though green slate is cited frequently in the descriptions of exports from (for example) China, Italy and Spain, purple

slate exports were mentioned infrequently (China).

In any one location, the popular colours are decreed by past use, tempered by current fashions. Limiting factors are availability and price. Australia, which produces green, purple and grey, imports additional green slate from China. The major Australian importer has previously investigated Vermont green, red and purple slate in addition to English slate, indicating that the company sees a possible market for these colours in Australia. This company was cautious about Newfoundland green, which would have to either compete with Chinese green on a price basis, or be of a superior quality.

The Netherlands is an example of a country where fashion has recently influenced the slate market. Black, grey and brown slate floors were popular up until a few years ago when tastes turned to polished white floors. Opinions differed amongst dealers as to whether the white era is still with the Dutch. One maintained that tastes have already turned warmer colours, while anotherindicated that although they stock mainly black and grey they would also be interested in examining other colours.

Architectural Facings and Shapes

It seems that this market might be considered in two parts dependent on the dimensions of slate used. Smaller architectural pieces are used for interior wall facings, skirtings, window sills and stairtreads, often in con-

junction with slate flooring contracts in lobbies and other public spaces of commercial and institutional buildings. This segment should be considered as a potential market for the Newfoundland producer.

Price

The prices paid around the world for worked dimension slate range from less than 300 to several thousand dollars per tonne. Some approximate price levels from this survey are shown as examples in diagram 9. In this diagram the diagonals reprsent the cost of delivery at C$100/tonne if a diagonal is followed to the left from a point corresponding to the transportation cost, a rough order of magnitude for net return at the quarry can be determined (neglecting tariffs).

Prices from Spanish and UK suppliers have shown some increases in the past year and dealers in the US and the UK note that the price advantage of Spanish slate has been partly eroded in 1987. Spanish suppliers have put through two increases of 8 and 10 per cent and have recently notified US buyers of a further 8 per cent rise in 1988. US domestic producers' prices have remained very constant.

Tariffs

Tariff data are laid out in Appendix F. Rough slate enters most countries duty-free. Slate to the EEC faces duty of 3.8 per cent and to the US between 3.7 and 6.6 per cent

Canada and Australia enjoy tariff levels of about 10 per cent other than for roofing slate, which enters Canada duty free. The 10 per cent duty is in the process of being reduced at the rate of 0.5 per cent per year.

Rates of Exchange

A concensus of current predictions is that the Canadian dollar will maintain a level of 78 cents US during 1988 and predictions for 1992 range from 78 to 82 cents US. With respect to the Deutschmark the US dollar is at present predicted to remain at a low level around 1.62 DM/US$ during 1988 and recover slowly to reach 1.70 ±0.03 during the period 1990 - 1992. The loss of advantage in the Canadian rate (from an exporter's standpoint) that occurred with respect to the US dollar in late 1987 can therefore be expected to continue in to the early 1990's.

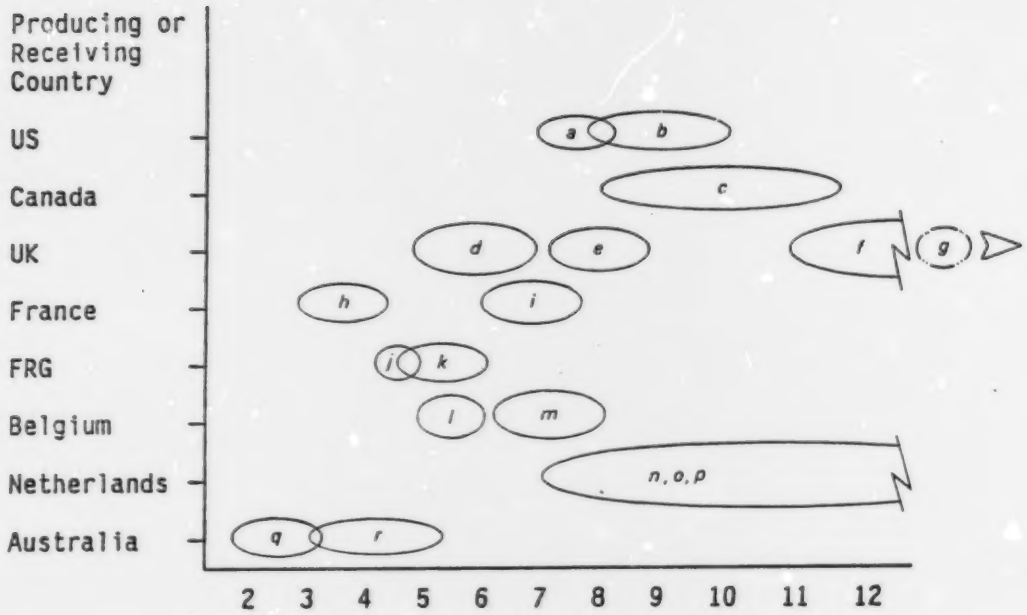
Vis a vis the Deutschmark, Swiss and Belgian franc and guilder, if the US dollar recovers as forecast after 1988, this effect will be reinforced. The weaker European currencies such as the lira and Spanish peseta, are forecast to fall at 5 and 10 per cent per year respectively with respect to the US dollar during the period to 1992. The pound sterling is likewise projected to fall markedly versus the US dollar in the years 1989 to 1992.

From the standpoint of the Canadian slate exporter, therefore, the outlook after 1988 is that Canada's terms of trade are likely to worsen during the period with respect to

both export pricing and the pricing of competing imports entering potential client countries.

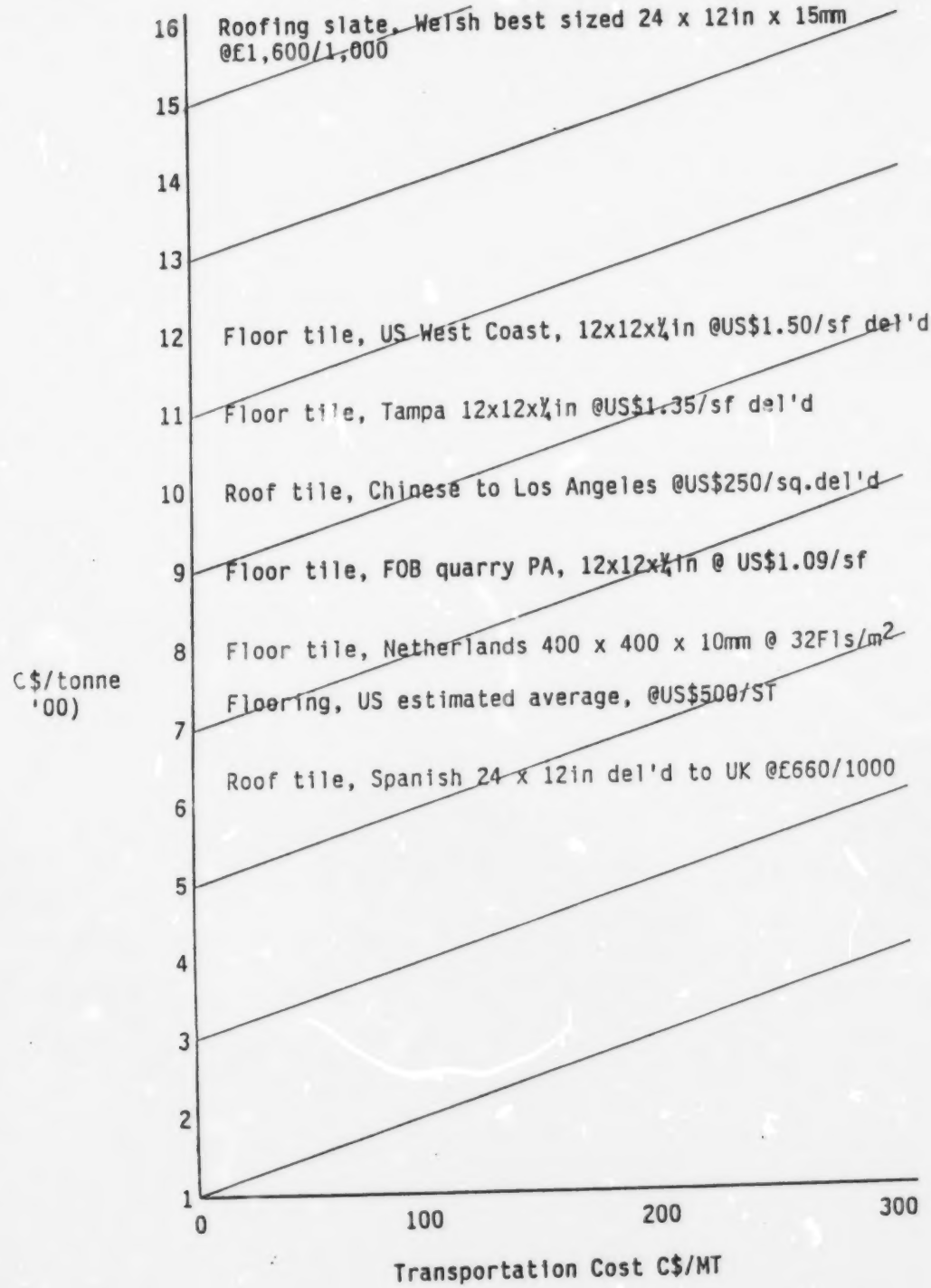
Sources: Dept. of Finance; Government of Newfoundland and Labrador; Canadian Imperial Bank of Commerce.

DIAGRAM 8
Ranges of Price/Customs Value of Slate



a. *US Bureau of Mines - roofing and structural*
b. *Floor tile, US West Coast*
c. *Newfoundland slate to UK, delivered (enquiry)*
d. *Spanish roof tile*
e. *Welsh 12 x 12in roof tile*
f. *Welsh 24 x 12in roof tile*
g. *Lake District roof tile (off scale)*
h. *Spanish roof tile*
i. *UK roof tile*
j. *Roofing*
k. *Blocks*
l. *Spanish roof tile*
m. *UK roof tile*
n. *Unspecified slate from China*
o. *Unspecified from India*
p. *Unspecified from Norway*
q. *Delivered floor tile, China and India*
r. *Floor tile US and UK*

DIAGRAM 9
Selected Estimates of Delivered Slate Prices



Transportation

Overview

Transportion is a crucial cost factor to be faced by Newfoundland producers. In general, slate consuming areas grew up around slate quarrying areas and, though, as in Germany and France, regional demand outstripped the indigenous quarry's capacity to supply, nevertheless in most of these established markets, the domestic producer still operates and therefore holds the advantage in transport costs. In addition, of course, he has the further advantage of having traditional usage built up around his products.

The increasing trade in slate has two major effects however: the domestic producer is challenged on his home ground by imports from producers with lower labour costs. In the case of Spain, these are also high volume producers. The traditional producer, on the other hand, responds by developing export markets where a product speciality, his technology, and applications expertise can be sold to advantage. Thus transportation cost is a common factor in many markets.

The Newfoundland producer is neither the best placed nor the worst. In principle, the advantages of international shipping rates are available to export destinations, reachable by sea, but, in practice, Newfoundland is not a point of origin or port of call on major freight liner routes. Bulk shipments by general cargo ships are not a current possibility.

Advantageous shipping rates by road and rail are available westward to Canadian destinations by virtue of the Atlantic Region Freight Assistance Programs. These go some way to reducing Newfoundland's locational penalty with respect to destinations in central Canada.

With respect to Western US destinations, the US producers are penalized by the requirements of the Jones Act to ship in US ships with US crews and are thereby at a disadvantage with respect to imports. Notwithstanding efforts by the Canadian shipping industry during the free trade negotiations to have this type of provision extended to Canada-US trade, no such provision was included. Canadian water-borne shipments to the US should therefore continue to be governed by the normal conference and non-conference rates available internationally.

A recent renewal of the Shipping Conference Exemption Act reduces somewhat the exclusivity formerly imposed by conference lines and this has improved the shipper's ability to deal with both conference and non-conference lines as required in the negotiation of rates. Eastbound trans Atlantic rates are generally lower than westbound and rates.

No commodity rates are published for slate, but do exist for ceramic tile.

Examples of approximate container rates (20 to 27 tonnes, according to mode) are as follows: (Canadian dollars).

Destination:

<u>Canada</u>		
Toronto:	Rail	$2,000 after ARFRA adjustments
	Road	$3,500
	Water/Road	$2,000
Halifax:	Water	$1,400
<u>United States</u>		
New York:	Road	$3,500
	Water/Road	$2,500
Philadelphia:	Water	$4,500
Chicago:	Water/Road	$3,000
Tampa:	Road	$5,500
Los Angeles:	Water	$4,000
<u>UK/Europe</u>		
Most ports	Water	$4,000
<u>Pacific Run</u>		
Japanese ports	Water	$4,000
Hong Kong	Water	$4,000
Sydney Australia	Water	$7,000

These should be taken as indicative rates, serving as a basis from which specfic negotiation of rates for actual shipments would begin. No adjustment for westbound or Maritime subsidy is included, unless specifically noted.

All water rates include road transport to the port of St. John's, trans-shipment at both ends and road transport in a 50 mile radius at the port of destination (Appendix O).

Strategy

The foregoing demonstrates the wide range of price statistics accumulated in this Survey and the uncertainties inherent in the outlook for exchange rates. Given also the reluctance of the slate trade to talk price in the absence of sample quantities, more accurate assessment of viable alternative markets can only be pursued by means of the marketing efforts of the producer. These involve negotiations regarding specific applications, the provision of samples, quotations and delivery schedules; and by shopping for specific shipping deals. We recommend that this be done in the context of the following discussion.

If one is to be a commodity seller in the current climate of ready trade from low cost producing countries, then one also has to be a low-cost producer. This can perhaps be achieved in the manner of the smaller Vermont producers but location, labour costs, the situation and the characteristics of the stone deposit, all mitigate against this low-overhead, swing-production approachin Newfoundland.

It is our view that for long-term viability, a Newfoundland producer - remote from markets and operating on a small scale - should not be a "me-too" producer, supplying only a commodity. Vulnerability to swings in the market is too great.

An alternative approach is to develop a product identity both by a promotional campaign and by developing

specific product attributes or specialties. To market the product in this way requires time and money to build up a number of capabilities:

- a familiarity with the market
- a product range with specific attributes
- an identity allied with the product attributes
- reliable delivery capability
- a technical selling capability
- the adoption of technology to develop the product range and improve costs.

These are difficult objectives for a small producer starting virtually from scratch. The required steps would be:

. development of the currently successful product lines, with emphasis on:
  - size
  - uniformity
  - control and screening of quality

We would suggest also:

. The formation of an alliance with a technically progressive firm already active in the slate marketing business, to whom Newfoundland slate has the advantage of being a complementary product (if such can be identified).

The immediate concern should be to continue to capitalize on the boom in US roofing slate business and to build up the US liaison to the point where Newfoundland be-

comes established as a supplier of a given segment of the Vermont business.

The second concern should be to apply the points set out above to the problems of capturing the major share of the Canadian market.

Broadly, let us suppose that the total market for architectural slate in Canada is approximately $1.5 million per year at the level of sales to contractors and major outlets, and growing at an annual rate of something less than 10 per cent. At a maximum, 20 per cent of this is roofing slate. Assign a sales value of C$600 per square and this corresponds to, say, 500 squares annually.

Assume also, at first approximation that the balance is 1/4in gauged flooring with say 15 per cent associated wall tile at an overall average sales value (again direct to contractors and major outlets) of $3.00 sq ft. this equates to 400,000 sq ft. The assumption of some percentage ungauged and a percentage of thicker gauged tile will lead to roughly the same result, though the associated tonnage will change.

Now assume market shares, say by late 1988 as follows, for colour, price and other considerations:

Flooring and associated tile:

	% Canadian Market	NF Share	Square feet
green	50%	50%	100,000
grey & black	40%	0%	-
purple	10%	80%	3,200
red	neglect for now	-	

Roofing

Assume 50 per cent share = 250 squares.

These figures represent about 25 per cent of the existing Newfoundland and production capacity and since domestic rates are generally the most profitable, it is from these that the producer's base income must be made.

However, the large percentage of capacity over and above the feasible Canadian market-share lends point to the observations made here, concerning the need to develop the means of participating in broader markets.

A major question concerning the upgrading of the product line is that of whether to produce gauged floor tile. The practice of most major producers is to undertake finishing operations and the price relationships shown in the discussion on the Canadian market suggest that this is the proper course to take (p.79; Appendix Q). If so, then the relationship to be established with Canadian processor/dealers needs careful consideration, given the various viewpoints presented in this survey concerning the marketing of floor tile and the make-up of the floor-tile market.

With the help of the right marketing partner, a technically aggressive approach can be taken to identify the characteristics which Newfoundland stone can best satisfy. Production methods and standards to suit should first be developed to improve existing products, followed by product development based on feedback from the technical selling

program and the need to complement each others' products. Promotion directed at users and dealers/agents and based upon product identify, should be a joint effort, making use of the partner's industry and client contacts.

To obtain the flexibility in marketing that the Newfoundland location requires, the partner should be active in a number of markets, both geographically and in terms of product range. Therefore, we feel, he is more likely to be a slate producer, than to be in the form of one or more dealers or agents, for most of whom spheres of interest are localized. In many cases, though not all, slate products constitute a small proportion of a dealer's, or agent's business. Dealers can and do combine the promotion and selling of slate products with other product lines and thus achieve some economy of effort, or even synergism. Arrangements with specific dealers would be a natural concomitant of the alliance suggested above. Nevertheless, the primary alliance should be at the producer level for the sake of the breadth of exposure and the technology transfer considerations.

In the event that an additional producer operates in Newfoundland, care should be taken to avoid fragmenting the Newfoundland marketing effort, in view of its small size on the scale of world markets and the need to establish an identity.

Product Development Strategy

A number of indications arise from this survey. They are not new to those in the slate trade in Newfoundland and in Canada, but they deserve repetition here.

1. Larger sizes are in demand in roofing and flooring markets, whether in Canada, the US or overseas. This applies to commodity flooring, where rectangular shapes and dimensions less than 12in are at a discount; in architectural flooring, where sizes greater than 12 x 12in are in growing demand; and in the European flooring market where the demand for larger sizes of in stone floor tile and slabs is established.
2. The non-weathering green slate is in strong demand for roofing in the US. Emphasis on the production of this should therefore be continued.
3. Uniformity and consistent quality of product are a selling point when they are achieved and a cost to the customer when they are not. In particular:

   . under-thickness ungauged floor tiles results in "semi-gauged" finished tiles which must be moved at a discount by the tile producer;
   . warped slate results in higher reject rates for both roofing slate and floor tile producers;
   . low warp and uniformity of thickness are important for the accurate installation of

both gauged and ungauged tile and slab;

- pyrite content increases equipment wear;
- pyrite and calcite inclusions reduce acceptance by the ultimate customer;
- hardness variations cause equipment wear and increase reject slate;
- dimensional variations result in uneven grouting and the poor appearance of installed floors;

4. Slate, from various sources has, in many instances engendered a poor reputation for durability in various atmospheric conditions.
5. The grey-olive green colour of the slate at present in production does not have outstanding appeal as a floor tile material.
6. Red slate is in demand.
7. Purple slate is something of an unknown quantity.

One other area of possible long term opportunity was indicated at least for limited further review: the supply of coloured powder and possibly granules for particular applications in specific markets.

On the above basis we propose a product-development and R & D program.

1. Quarrying and Processing

   a. determine the potential for quarrying large blocks of stone in terms of the characteristics of the Newfoundland slate deposits;

   b. In the light of (a) assess the financial feasibility of installing methods of access and quarrying equipment to optimize the slab size presented to the sawing stations;

   c. review processing methods and equipment to achieve the minimum reductions in size at each step when producing both roof tile and flooring stock;

   d. Review the potential for increased production of blue-green slate.

   e. Estimate the cost of entering production of red slate and review the product quality, yields and dimensions likely to be obtained.

2. Testing

   Undertake a program for testing:

   a. to determine the variability of physical properties in the product ion from a given quarry or deposit;

   b. to determine the corresponding test values on a wide variety of competitive slate samples from various sources world wide;

   c. perhaps to relate these properties to the properties of various competing stones and

man-made materials;

d. to relate these properties to the comparative performance of Newfoundland slates vis-a-vis others in various exposures, such as to heavy traffic, to freeze/thaw cycles; and

e. to assess quality control procedures which will be meaningful to the customer - whether specifier or processor - and which will result in saleable cost advantages to the customer.

3. Market Review

a. Review the market for red slate and determine whether requirements are positive for the development of red slate from Newfoundland.

b. Review the potential market for purple slate in detail (and Newfoundland black and grey slates in less detail). In this respect it may be a better concentration of effort initially to allow the black and grey required in a product mix to be supplied by arrangement with other quarries or dealers, as is the practice in the US.

c. Review the technical basis for the advantage of slate powders as fillers in specific uses and conduct a preliminary market and economic review of the production of coloured powders and granules;

d. Characterize the freeze-thaw stability of Newfoundland slate to establish the advantages

and disadvantages in marketing outdoor use;

e. Consider the possibility of developing a counter to the negative opinions expressed concerning slate as an interior flooring material;

1. that it is dusty

2. that its sealer must be stripped and resealed yearly.

Summary

In the 1980's there has been marked growth in the markets for architectural slate in a few specific countries.It has been accompanied by greatly increased exporting activity by countries with relatively low costs, which has kept prices down, particularly in the lower quality and less specialized parts of the market. Some established producers have expanded and modernized to meet these conditions and are continuing to do so in 1988. They have many competitive advantages including economies of scale, established reputations and proximity to domestic markets.

Newfoundland slate currently in production, or readily available for production, is a very minor proportion of the world production and it has certain limited advantages which, if carefully exploited, should allow it to compete in certain segments of the slate market in different countries. Participation in export markets is a necessity because of the relatively small Canadian demand.

The movement of exchange rates expected in the next few years will, however, tend to work against the Canadian exports. The effects of these rates generally outweigh any expected tariff changes.

Development of a product identity and a reputation based upon specific characteristics and quality is important, and the formation of an alliance with another producer who is technically advanced and knowledgeable in the market, would be an advantage.

If additional producers were to come on stream in Newfoundland, some form of cooperative marketing mechanism would be almost essential, given the international nature of the market.

DISCUSSION AND CONCLUSIONS

The trade and production statistics assembled in the course of this survey (incomplete though they often are) confirm the fact of overall growth in the world's slate industry in the 1980's. Opinions and comment from the industry confirm that this growth has been continued in 1987 and the modernization and expansion plans under way give every indication that the growth is expected to persist at least in the medium term.

If we look at the influence of changes in architectural style as a principal underlying factor of this growth, we do find a degree of concensus among the architects surveyed, that directionally at least, these trends have by no means run their course and should continue to encourage the use of material such as slate. However, when we came to pin down the individual architect's propensity to specify slate the responses are equivocal and it becomes apparent how many other materials compete for his or her attention on many fronts.

We have not, after all, attempted the exercise of relating slate consumption trends to economic indicators, since we suspect that the factors specific to each country, the effects of architectural fashion, and the supply-led effect of increasing low cost exports are overriding.

We do feel that there are two major observations stemming from this survey. The first is that, given that continuing growth in slate markets is to be expected - and a

rough concensus from a very reticent industry would be 5 to 10 per cent - it is must be viewed in the context of the very large expansion of slate exporting activity at prices below the established structure in the consuming countries. The second observation is that Newfoundland capacity, or even break-even volume, is likely to be well in excess of the amount of slate constituting a feasible share of the Canadian market.

The price indications to come out of the survey suggest, however, that there are export markets which can offer a positive return to a Newfoundland producer. To pursue them, we feel requires the type of approach which we have tried to indicate in the Chapter dealing with the Newfoundland Potential.

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Stone Industries

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APPENDIX B: Glossary of Stone Terms

ASHLAR - Masonry having a face of square or rectangular stones, either smooth or textured.

ANCHORS - Types for stonework include those made of flat stock (strap, cramps, dovetails, dowel, strap and dowel, and two-way anchors) and round stock (rod cramp, rod anchor, eyebolt and dowel, flat-hood wall tie and dowel, dowel and wire toggle bolts).

BED - (1)In granites and marbles, a layer or sheet of the rock mass that is horizontal, commonly curved and lenticular, as developed by fractures. Sometimes applied also to the surface of parting between sheets.
(2)In stratified rocks the unit layer formed by sedimentation; of variable thickness, and commonly tilted or distorted by subsequent deformation; generally develops a rock cleavage, parting, or jointing along the planes of stratification.

BUILDING STONE, NATURAL - Rock material in its natural state of composition and aggregation as it exists in the quarry and is usable in construction as dimension building stone.

CHAMFER - To bevel the junction of an exterior angle.

CLADDING - Non-load-bearing thin stone slabs used for facing buildings.

CLEAVAGE - The ability of a rock mass to break along natural surfaces; a surface of natural parting.

CLEAVAGE PLANE - Plane or planes along which a stone may likely break or delaminate.

COPING - A flat stone used as a cap on free-standing walls.

CUT STONE - This includes all stone cut or machined to give sizes, dimension or shape, and produced in accordance with working or shop drawings which have been developed from the architect's structural drawings.

CUTTING STOCK - A term used to describe slabs of varying size, finish, and thickness which are used in fabricating treads, risers, copings, borders, sills, stools, hearths, mantels, and other special purpose stones.

DIMENSION STONE - Natural building stone that has been selected, trimmed or cut to specified or indicated shapes or sizes with or without one or more mechanically dressed surfaces.

DOWEL - A short piece of non-ferrous metal or slate fixed into a mortice or sinking in the joints of adjoining stones to prevent movement.

FACE - This refers to the exposed portion of stone. The word "face" can also be used when referring to the edge treatment on various cutting stock materials.

FIREPROOF - Relatively incombustible.

FLAGSTONE - Thin slabs of stone used for flagging or paving walks, driveways, patios, etc. It is generally fine-grained sandstone, bluestone, quartzite or slate, but thin slabs of other stones may be used.

GANG SAWED - Description of the granular surface of stone resulting from gang sawing alone.

GAUGED or GAUGING - A grinding process to make all pieces of material to be used together the same thickness.

GRAIN - The easiest cleavage direction in a stone. "With the grain" same as "natural bed." Also, particles (crystals, sand grains, etc.) or a rock.

GRANITE - A fine to coarse-grained, igneous rock formed by volcanic action consisting of quartz, feldspar, and mica, with accessory minerals. Granite-type rocks include those of similar texture and origin.

HAND-CUT RANDOM RECTANGULAR ASHLAR - A pattern where all the stone is hand cut into squares and rectangulars. Joints are fairly consistent. Similar to sawed-bed ashlar in appearance.

HONED FINISH - Honed is a superfine smooth finish, though not as fine as a polished finish.

MARBLE - (Scientifie definition) A metamorphic (recrystallized) limestone composed predominantly of crystalline grains of calcite or dolomite, or both, having interlocking or mosaic texture. Marble that contains less than five percent magnesium carbonate may be termed calcite marble; from 5 to 40 percent magnesium carbonate, magnesian or dolomitic marble; and more than 40 per cent, dolomite marble. These limiting values are, however, not strictly established in petrologic science and are used herein as arbitrary limits.

METAMORPHISM - The change or alteration in a rock caused by exterior agencies, such as deep-seated heat and pressure, or intrusion of rock materials.

NATURAL BED - The setting of the stone on the same plane as it was formed in the ground. This generally applies to all stratified materials.

NATURAL CLEFT - This generally pertains to stones which are formed in layers in the ground. When such stones are cleaved or separated along a natural seam the remaining surface is referred to as a natural cleft surface.

PALLETIZED - A system of stacking stone on wooden pallets. Stone which comes palletized is easily moved and transported by modern handling equipment. Palletized stone generally arrives at the job site in better condition than unpalletized material.

POLISHED - The finest and smoothest finish available in stone characterized by a gloss or reflective property. Generally only possible on hard dense materials.

QUARRY - The location of an operation where a natural deposit of stone is removed from the ground.

QUARTZ - A silicon dioxide mineral that occurs in colorless and transparent or colored hexagonal crystals and also in crystalline masses. One of the most common minerals, the chief constituent of sandstone.

QUARTZITE - The compact granular rock composed of quartz crystals, usually so firmly cemented as to make the mass homogeneous. The stone is generally quarried in stratified layers, the surfaces of which are unusually smooth. Its crushing and tensile strengths are extremely high; the color range is wide.

RIPRAP - Irregular shaped stones used for facing bridge abutments and fills. Stones thrown together without order to form a foundation or sustaining walls.

RISE - The word "rise" refers to the heights of stone. Generally used in reference to veneer stone.

ROCK - An integral part of the earth's crust composed of an aggregate of grains of one or more minerals. (Stone is the commercial term applied to quarry products).

ROUGH SAWN - A marble surface finish accomplished by the gang sawing process.

RUBBED FINISH - Mechanically rubbed for smoother finish.

RUBBLE - A product term applied to dimension stone used for building purposes, chiefly walls and foundations, and consisting of irregularly shaped pieces, partly trimmed or squared, generally with one split or finished face, and selected and specified with a size. range.

SAND-SAWN FINISH - The surface left as the stone comes from the gang saw. Moderately smooth, granular surface varying with the texture and grade of stone.

SAWED EDGE - A clean cut edge generally achieved by cutting with a diamond blade, gang saw or wire saw.

SAWED FACE - A finish obtained from the process used in producing building stone. Varies in texture from smooth to rough and coincident with the type of materials used in sawing; characterized as diamond sawn, sand sawn, chat sawn, and shot sawn.

SILL - A flat stone used under windows, doors and other masonry openings.

SILTSTONE - A fine-grained non-carbonate clastic rock composed of at least 67 percent of detrital grains of quartz and silicate minerals of silt size. Siltstones are rarely marketed as such but commonly are considered as fine-grained sandstones. This class of sediments is texturally transitional between sandstones and shales (mudstones). Many bluestones and siliceous flagstones fall within this category. The term is included in these definitions chiefly to explain the relationship of some siliceous flagstones to the standstone category.

SLAB - A lengthwise cut of a large quarry block of stone.

SLATE - A very fine-grained metamorphic rock derived from sedimentary rock shale. Characterized by an excellent parallel cleavage entirely independent of original bedding, by which cleavage the rock may be split easily into relatively thin slab.

Essential mineral constituents of slates are usually members of the mica group, commonly sericite, muscovite, and paragonite; of the clay group, chiefly illite and kaolinite; and of the chlorite group. Common accessory minerals are iron oxides, calcite, quartz, and feldspar. Other minerals may be present also as minor accessories. Most slates are derived from shales. Others are derived from fine-grained igneous rock, chiefly volcanic tuffs, but these are rare and of little commercial importance.

SMOOTH FINISH - Description of the finish produced by planer machines plus the removal of objectionable tool marks. Also known as "smooth planer finish" and "smooth machine finish".

SNAPPED EDGE, QUARRY CUT or BROKEN EDGE - This generally refers to a natural breaking of a stone either by hand or machine. The break should be at right angles to the top and bottom surface.

SPALL - A stone fragment that has split or broken off.

SPALLS - Sizes may vary from chip-size to one- and two-man stones. Spalls are primarily used for taking up large voids in rough rubble or mosaic patterns.

SPANDREL WALL - That part of a curtain wall above the top of a window in one story and below the sill of the window in the story above.

SPLIT - Division of a rock by cleavage.

SPLIT FACE(SAWED BED) - Usually split face is sawed on the beds and is split either by hand or with machine so that the surface face of the stone exhibits the natural quarry texture.

STONE - Sometimes synonymous with rock, but more properly applied to individual blocks, masses or fragments taken from their original formation or considered for commercial use.

TOLERANCE - Dimensional allowance made for the inability of men and machines to fabricate a product of exact dimensions.

TRAVERTINE MARBLE - A variety of limestone regarded as a product of chemical precipitation from hot springs. Travertine is cellular with the cells usually concentrated in thin layers that display a stalactitic structure. Some that take a polish are sold as marble and may be classified as travertine marble under the class of "Commercial Marble".

TREAD - A flat stone used as the top walking surface on steps.

TRIM - Stone used as decorative items only, such as sills, coping, enframements, etc., with the facing of another material.

TUFF - Cemented volcanic ash, many varieties included.

VENEER STONE - Any stone used as a decorative facing material which is not meant to be load-bearing.

WEAR - The removal of material or impairment of surface finish through friction or impact use.

WEATHERING - (1)Natural alteration by either chemical or mechanical processes due to the action of constituents of the atmosphere, surface waters, soil and other ground waters, or to temperature changes.
(2)The inclined top surface of a stone such as a coping, cornice, or window sill.

WIRE SAW - A method of cutting stone by passing a twisted, multistrand wire over the stone and immersing the wire in a slurry of abrasive material.

Taken with permission from: Marble and Stone Slab Veneer by James E. Amrhein, S.E. and Michael W. Merrigan; published by the Masonry Institute of America, Los Angeles, California, USA.

APPENDIX C: List of Abbreviations

C$	Canadian dollars
US$	US dollars
£	Pound Sterling
FLS	Dutch guilders
sq ft	Square foot/feet
square	100 square feet
cu ft	Cubic foot/feet
sq m	Square metre
in	Inch
mm	Millimeter
cm	Centimetre
ST	Short ton
lb	Pound
tonne	Metric ton
oz	Ounce
US	United States of America
UK	United Kingdom
EEC	European Economic Community
FRG	Federal Republic of Germany
CIF	Cost, insurance and freight
NSPF	Not specifically provided for
FOB	Free on board
FST	Federal sales tax
CANMET	Canada Centre for Mineral and Energy Technology
BSI	British Standards Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CTC	Canadian Transport Commission
ARFRA	Atlantic Regional Freight Rate Assistance
FRP	Fibre reinforced plastic

APPENDIX D: International Exchange Rates
(Canadian dollars to one unit of foreign currency)

	1980	1981	1982	1983	1984	1985	1986	1987
Australia	1.3329	1.3789	1.2547	1.1114	1.1386	0.9574	0.9326	0.9974
Belgium	0.04013	0.03240	0.02709	0.02418	0.02238	0.02317	0.03120	0.036059
Eire	2.4063	1.9363	1.7538	1.5377	1.4068	1.4554	1.8635	2.0147
France	0.2771	0.2307	0.1885	0.1624	0.1487	0.1533	0.2010	0.2268
FRG	0.6444	0.5318	0.5086	0.4834	0.4564	0.4677	0.6425	0.7563
Hong Kong	0.2350	0.2153	0.2040	0.1707	0.1656	0.1753	0.1781	0.1748
Italy	0.001368	0.001061	0.000914	0.000814	0.000740	0.000715	0.000935	0.001048
Japan		0.005450	0.005110	0.005280	0.005339	0.005210	0.007037	
Netherlands	0.5892	0.4822	0.4622	0.4327	0.4048	0.4147	0.5695	0.6717
Norway	0.2378	0.2094	0.1923	0.1690	0.1599	0.1596	0.1881	0.2055
Portugal	0.02340	0.01964	0.01569	0.01129	0.008848	0.008002	0.009293	0.0097
Spain	0.01635	0.01305	0.01128	0.008632	0.008074	0.008054	0.009935	0.01131
Switzerland	0.6986	0.6122	0.6091	0.5873	0.5527	0.5615	0.7769	
UK	2.7196	2.4287	2.1579	1.8683	1.7300	1.7701	2.0388	2.2246
USA	1.1690	1.1990	1.2341	1.2324	1.2948	1.3652	1.3894	1.337

Prediction

	DM/USD[1]	DM/USD[2]	USD/£[1]	USD/[3]	CD/USD[3]	USD/CD[2]	Lira/DM[2]	Peseta/USD[3]	Austr/UDS[3]
1987(Q4)	1.71		1.75				732	123	1.43
1988	1.62	1.45	1.78	1.90-2.05	1.29	.75-.80	757	116	1.51
1990	1.66		1.57		1.29		835	146	1.67
1992	1.77		1.33		1.29		920	175	1.72

1 Bank of Montreal
2 Bank of Nova Scotia
3 Bank of Commerce

APPENDIX E: Tariff Classifications prior to Harmonization on January 1, 1988

COUNTRIES	CODE	COMMODITY DESCRIPTION
Canada	30900-1	Roofing slate
	31000-1	Manufacturers of slate
	31100-1	Slate pencils and writing slate
	31105-1	Blackboard slate
US	515 1100	Roofing slate
	515 1400	Articles of Slate NSPF* (ie except roofing)
Most other countries	2514 0000	Slate (including slate not further worked than roughly split, roughly squared or squared by sawing).
	2514 1000	Slate powder, crushed stone and scrap
	2514 1200	Others
	6803	Slate, worked and articles of slate (including articles of agglomerated slate)
	6803 1100	Roofing and wall tiles
	6803 1600	Blocks, plates, flags and slabs (other than in 1100).
	6803 9000	Other
	9805	Slate pencils
	9806	Blackboards

Sources: UK Guide to the Classification for Overseas Trade Statistics, 1986.
Swiss tariff statistics.

* Not specifically provided for

APPENDIX F: Harmonized Tariff System from January 1, 1988

COUNTRIES	CODE	COMMODITY DESCRIPTION	DUTY
EEC*	251400 00 0 00	Slate whether or not roughly trimmed or merely cut by sawing or otherwise into blocks or slabs of a rectangular (including square) shape	Free
	6803	Worked slate and articles of slate or of agglomerated slate	
	680300 10 0 00	Roofing and wall slate	3.8%
	680300 90 0 00	Other	3.8%
	961000 00 0 00	Slates and boards with writing or drawing surfaces whether or not framed	5.6%
	9609	Pencils, crayons, pencil leads, pastels, drawing charcoals, writing or drawing chalks and tailor's chalk	
	960990 90 0 00	Other (probably incorporates slate pencils)	3.3%
CANADA	2514.00	Slate whether or not roughly trimmed or merely cut by sawing or otherwise into blocks or slabs of a rectangular (including square) shape	
	2514.0010	Crude or roughly trimmed	Free
	2514.0020	Merely cut by sawing or otherwise into blocks or slabs of a rectangular (including square) shape	MFN 5.5% (US,EEC,JAPAN) GP 3.5% (Developing countries) BP 5.0% (Australia) Free (New Zealand)
	2514.0090	Other including powder and waste	MFN 10.2% (US EEC JAPAN) GP 6.5% (Developing countries) BP 10.2% (Australia & New Zealand)
	6803.00	Worked slate and articles of slate or of agglomerated slate	
	6803.0010	Roofing slate	Free

COUNTRIES	CODE	COMMODITY DESCRIPTION	DUTY
	6803 0050**	Other	MFN, 10.2% (US EEC JAPAN) GP 6.5% (Developing Countries) BP 10.2% (Australia & New Zealand)
US	2514.00	Slate whether or not roughly trimmed or merely cut by sawing or otherwise into blocks or slabs of a rectangular (including square) shape.	MFN 3.7% (Includes Canada) Free (Developing Countries, Israel, Caribbean except Australia and New Zealand)
	6803.00	Blocks, slabs and sheets other than rectangular, roofing and building cubes, writing slates and blackboards	
	6803.0010	Roofing slate	MFN 6.6%
	6803.0050	Other	MFN 3.7%
AUSTRALIA	2514.00	Slate whether or not roughly trimmed or merely cut by sawing or otherwise into blocks or slabs of a rectangular shape	10.0% 5.0% (Developing Countries)
BRAZIL			45.0%
HONG KONG			Free
JAPAN	2514.00		Free

SOURCES: Tariff Schedules
Canadian Embassies

* The EEC currently comprises the following countries: Belgium, Denmark, France, UK, Greece, FRG, Eire, Italy, Luxembourg, Netherlands, Portugal and Spain.

** Spain and Portugal, currently in their 2nd year of full EEC membership, have 7 years to bring their duty rates into line. Duty on 6803 items currently ranges between 4.3% and 5.8%.

APPENDIX G1: American Standards

Relevant Standards:

ASTM Designation: C119-87
Standard Definitions of Terms Relating to NATURAL BUILDING STONES

ASTM Designation: C629-85
Standard Specification for SLATE BUILDING STONE

ASTM Designation: C406-84
Standard Specification for ROOFING SLATE

ASTM Designation: C120-85
Standard Methods of FLEXURE TESTING OF SLATE (MODULUS OF RUPTURE, MODULUS OF ELASTICITY)

ASTM Designation: C121-85
Standard Test Method for WATER ABSORPTION OF SLATE

ASTM Designation: C217-85
Standard Test Method for WEATHER RESISTANCE OF NATURAL SLATE

ASTM Designation: C241-85
Standard Test Method for ABRASION RESISTANCE OF STONE SUBJECTED TO FOOT TRAFFIC.

These documents are copyright and therefore not reproduced here.
ASTM Standards are available from:

Sales Department
American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA
19103 USA

APPENDIX G2: British Standards

Relevant Standard:

British Standard 680: Part 2: 1971
Specification for Roo ing Slates
Part 2 Metric Units.

This document is copyright and therefore not reproduced here. It is available from:

Sales Department
Standards Council of Canada
350 Sparks Street
Ottawa, Ontario
Canada, K1P 6N7

Summary

The document lists the particulars which must be included in a marketing description in order to comply with the British Standard. Guidelines are laid down for the description of:

Name of the source of origin;
Name of colour or rock, or description by which the slates are known;
Thickness, graded or ungraded;
Length and width.

In addition to the procedure for preparing test specimens, tests are prescribed for:

Water absorption;
Wetting and drying;
Sulphuric acid immersion.

The parameters for test results to suit slates for use under two different levels of atmospheric pollution are laid down.

Note: BS 680 is currently undergoing comprehensive revision.

APPENDIX G3: German Standards

Relevant Standards:

DIN 52201 (German text)
Roofing Slates: definition and methods of test.

DIN 52204 (German text).
Testing of roofing slates: temperature alternating test.

DIN 52206 (English text)
Acid Resistance of roofing slate test.

These documents are available from:

Sales Department
American National Standards Institute (ANSI)
1430 Broadway
New York, NY
10018 USA

APPENDIX H: Selected Trade Exhibitions and Shows

Date	Location	Details	Contact
28-31 May 1987	Nuremberg West Germany	Trade Exhibition - Natural Stones and Stone Working Machines	Ernst Spielvogel KG Tel: 08282-4091
1-3 Nov 1987	Orlando Florida, USA	International Tile Exposition (Orange County Convention Centre)	Association of Title, Terrazzo, Marble Contractors & Affiliates (ATTMACA)
18-19 Nov 1987	Boston USA	Build Boston '87 (Boston World Trade Centre)	Boston Society of Architects
10-14 Dec 1987 (biannual)	Batimat France	Exhibition of Building Construction Materials	Royal Export Tel:011-33-41-88-98-02
8-10 Jan, 1988	Boston USA	America East, Building Materials Exposition (Boston Convention Centre)	F J Laberge, Dept External Affairs
18-21 Mar 1988	Orlando Florida, USA	StonExpo '88 (Orlando Expo Centre)	Allied Stone Industries
13-14 Apr 1988 (annual)	Phoenix Arizona, USA	Southwest Builds (Phoenix Civic Plaza)	The Arizona Society of the A/A
May/June 1988 (annual)	Carrara, Italy	International Marble & Machine Fair	Internatzionale Marmi e Macchine Carrara
24-26 June 1988 (annual)	Washington DC USA	The Construction Specifiers Institute, 32nd Annual Convention and Exhibit	John W Atherton Tel: 703-684-0300
end Sept 1988 (annual)	Verona Italy	Marmomacchine (Fair Complex, Sant'Ambrogio di Valpolicella)	G Pignatti Tel: 011-39-45-588111
end Oct 1988	Dublin Eire	Building Trades Show	Capco Tel: 011-353-1-902755
mid Nov 1988	London England, UK	Rooftec '88 (Royal Horticultural Halls)	R W Wormell, NFRC Tel: 011-44-1-734-9164
autumn 1989	England, UK	Interbuild	Unilink 5 Donalda Crescent Agincourt, Ont Canada, M1S 1N5

Trafalgar House development, Guild St, Aberdeen, Scotland.

Crematorium, Acklam Road, Middlesbrough, England.

Hornes Tailors, 44 shop fronts, UK.

St Paul Place, Dallas, TX; Bench; Green and black.

San Francisco Airport; Walls, column bases; Green.

John B Hynes Veterans Memorial Convention Center, Boston, MA; Arches and column bases; Green.

Bayside Marketplace, Biscayne Bay, FL; Floor paving; Green

100 William St, NYC. Exterior cladding for office building. Black. Originally Portuguese slate. Problems developed with warping of the panels. Completed with Virginia slate.

Sources: British Stone Federation
Dimensional Stone
Stone Industries
Stone World

APPENDIX I: Examples of Architectural Slate Contracts 1972 - 1986 (USA, Canada & UK)

Logan Airport International Terminal, Boston, MA; Green, 160,000 sq ft.

Water Ridge project San Diego, CA; 40,000 sq ft.

President Roosevelt Library, Hyde Park, NY

IBM Office Complex, Research Triangle Park, NC; Stairways.

Flooring, Atrium and dining areas (1/4in thick); stairways; (1in thick). Red; 30,000 sq ft total. Architects, Geddes,Brucher, Qualls, Cunningham: Philadelphia.

California Plaza, Los Angeles; Flooring in conjunction with pink granite; Dark Green; Natural cleft; 4,000sq 3/4in thick; Fountains, honed finish; 500 sq ft.

University of Pennsylvania; Paving; Green.

Delmonico Plaza, Manhattan, 24 stories; Cladding, flooring and interior finishes, balcony rails; Green; 100 tonnes.

CitiCorp Plaza, Los Angeles; Flooring, capping, kerbs, gutters, planters, in conjunction with granite cladding; Green; 45,000 sq ft. Architects; Jerde Partnership. Landscape Architects; SWA group (Boston MA and Sansalito CA; John Wong).

The Atrium, Irvine CA; Cladding; Green; 115,000 sq ft.

Beckton Dickinson corporate HQ, Franklin Lake, MA; in conjunction with granite; blue-black and silver-grey; 140 tonnes.

Bank of Canada, Ottawa; 11 storey extension, green foyer flooring, and walls; Patio; In conjunction with green granite; In progress.

Porsche Cars Great Britain Ltd. Theale, Berkshire, England.

New Berkeley Hotel, London England; Cladding.

Allied Irish Bank HQ, Coleman Street, London, England.

Sovereign House, Victoria, London, Atrium paving and walling.

Laings Development, Carlisle, England.

Atrium Building, Irvine, CA, USA

Townsend Thorensen Office, Wilton Road, London, England.

APPENDIX J1: Selected Slate Dealers (including quarries)

AUSTRALIA

The Slate People
100 Victoria Road
Drummoyne
New South Wales 2047
Tel: 011-61-2-819-6933
(Slate Dealer)

BELGIUM

Deltamat
Avenue Brugmann 29
B-1060 Bruxelles
Tel: 011-32-2-539-22-40
Telex: 46 22603
(Dealer)

Haentjes Bvba
Platin & Moretuslei 62
B-2018 Antwerpen
(Importer)

Hansez & Co
Bd Saint-Michel 28
B-1040 Bruxelles
(Importer)

Stone NV
Autostrado Km 19
B-2900 Londerzool
Tel: 011-32-52-30-03-41
Telex: 46 25156 Stone B
(Stone Producer/Dealer)

Vandenbroucke-Detollenaere NV
H Lebbestraat 190
B-8790 Waregem
Tel: 011-32-56-80-27-92
Telex: 46 85129 Vdbwar B
(Dealer)

CANADA

Acme Slate & Tile
21 Golden Gate Court
Scarborough, Ont
M1P 3A4
Tel: 416-293-3664

Bedford Slate Ltd
2609-500 Laurier W
Ottawa, Ont
K1R 5E1
Tel: 613-232-5634

New England Slate Ltd.
1910 Effingham Road
Bridgeville, Ont
Mailing: P O Box 5056
St. Catherine's, Ont
Canada
L2R 6V9
Tel: 416-892-5793

EIRE

Capco Ltd
Mount Tallant Avenue
Terenure
Dublin 6
Tel: 011-353-1-902755
(Roofing Product Importer/Distributor)

FRANCE

Ardoisières d'Angers
52 Boulevard du Roi René
BP 008-49005
Angers, Cedex
011-33-41-88-98-02
Telex: 42 720948
(Producer & Dealer)

Royal Export
7 Rue de Montevideo
75116 Paris
Tel;: 011-33-1-45-03-33-87Tel:
Telex: 42-616635
(Dealer)

FRG

Gebr Tommes KG
Schiefergruben
5948 Nordenau - Stadt
Schmallenberg
Tel: 02975-221
(Producer & Dealer)

Hesse und Schneider KG
Postfach 22 04
5948 Schmallenberg
2 Fredeburg
Tel: 0297-7059
(Producer & Dealer)

Prange GMBH
Postfach 15 47
5790 Brilon
Tel: 02961-4057
(Producer & Dealer)

J B Rathscheck Soehne KG
Postfach 15 68
5440 Mayen
Tel: 02651-43-04-1
(Producer & Dealer)

Lother Spengler
Schieferberg 2
5778 Meschede-Heinrichsthal
Tel: 0291-50566
(Producer & Dealer)

Schiefergruben Magog GMBH
und Co KG
Alter Bahnhof 9
5948 Schmallenberg
2 Fredeburg
Tel: 02974-219
(Producer & Dealer)

Schieferwerk Wissenbach GMBH
6345 Eschenburg 2
Tel: 02774-6041
(Producer & Dealer)

INDIA

Seihk Hussain Bali
Reddy
P O Vinukonda
District Guntur
Andhra Pradesh
(Producer/Exporter)

Shyamalal H Bawadinwala
Silawar Galli
Distrct Mandsaur
Madhya Pradesh
(Producer/Exporter)

Shri C H Butchirayam
Gopala Krishna Street
Ramroa Pet
Kakinada 4
District Prakasam
Andhra Pradesh
(Producer/Exporter)

Ibne Hussain Haji Ibrahim
Bismilla Manzil
Road No 1
District Mandsaur
Madhya Pradesh
(Producer/Exporter)

Kashiram & Sons
30 Manu Marg
Alwar - 301 001
Rajasthan
(Producer/Exporter)

Patidar Slate Pen Works
District Mandsaur
Madhya Pradesh
(Producer/Exporter)

Shri Kashiram Ramdayal Gupta
P O Piplia
District Mandsaur
Madhya Pradesh
(Producer/Exporter)

Haryana Minerals Ltd.
Nizampur Road
Narnaul
District Mahendragarh
Haryana
(Producer/Exporter)

Abdul Ajij H Ibrahim
P O Dhariakhedi
District Mandsaur
Madhya Pradesh
(Producer/Exporter)

Shri Kuldeep Singh Sahary
Akalkar Building
Station Road
District Mandsaur
Madhya Pradesh
(Producer/Exporter)

Ashok Somany
P O Kund
District Mahendragarh
Haryana
(Producer/Exporter)

Shri A. Srimannarayana
P O Vinukonda
District Guntur
Andhra Pradesh
(Producer/Exporter)

Gopichand Yadav
P O Kayasa
District Alwar
Rajasthan
(Producer/Exporter)

ITALY

Arata Paolo and C SPA
Piazza Mazzini 18
Chivari 16043
Tel: (0185) 300241
Telex: 43 270569 Slate I
(Producer/Exporter)

Arata - STQ
Monleone
Cicagna 16040
Tel: (0185) 92000
Telex: 43 270630 PP-Chv I Att Stq
(Producer/Exporter)

Ardesit di Vittorio Quinto
Monleone va Grosso 80
Cicagna 16040
Tel: (0185) 92018
(Producer/Esporter)

Bernacca Ercole
Via Circonvallazione 21
Carrara 54033
(Producer/Exporter)

Euroslate SNC
Monleone
Cicagna 16040
Tel: (0185) 348042
Telex: 43 271698 Aravit I
(Producer/Exporter)

Italardesia SNC
Monleone
Cicagna 16040
Tel: (0185) 348024
Telex: 43 271698 Aravit I
(Producer/Exporter)

L'Ardesia Dei Filli Grecco
Via Molino del Drago 14
Cicagna 16044
Tel: (0185) 92141
(Producer/Esporter)

Leani-Ardesie SNC
Monleone Via Isola Lunga I
Cicagna 16040
Tel: (0185) 92190
Telex: 43 222805 Gandc I
(Producer/Exporter)

Mineraria Marittima SRL
Avenza-via Antica di Massa 67
Carrara 54031
Tel: (0585) 56466
Telex: 43 500268 Mimar I
(Producer/Exporter)

Nicem Nuova Calcite e Marmi
Via Nazionale 1
Casazza 24060
Tel: (035) 810069
(Producer/Exporter)

JAPAN

Sekigahara Sekizai Co
2682 Sekigahara - cho
Huwa-gun
Gihu-ken
Tel: 05844-2-1234
(Stone Importer)

Yabashi Dairiseki Co
273 Akasaka-cho
Oogaki-shi
Mie-ken
Tel: 0584-71-1211
(Stone Importer)

Tohoku Kogyo Co
2-13-45 Kami-Oosaki
Shinagawa-ku
Tokyo
Tel: 03-440-1401

LUXEMBOURG

Hoffmann, Engel & Cie
Rue de Bitbourg 9
L-1273 Luxembourg
Tel: 011-352-43-68-71
Telex: 46 1668 Hegre Lu
(Importer)

Marbrerie Micheline Sarl
Route Dudelange
L-3322 Bettembourg
(Importer)

Rinnen J P & Fils Sarl
Route de Bastogne 2
L-9706 Clervaux
Tel: 011-352-9-11-63 & 9-13-22
Telex: 46 1327 Rinemi Lu
(Importer)

NETHERLANDS

Eurostone BV
P O Box 171
6600 AD Wijchen
Tel: (8894)-16717
Telex: 44 48777 Eston NL
(Importer)

Gebr Grillo Natursteen BV
Handelsstrat 30
6851 EH Huissen
Tel: 011-31-85-259022
Telex: 44 45088 Gegri NL
(Importer)

Hessels Natuursteenhandel BV
P O Box 415
1000 AK Amsterdam
Tel: 011-31-20-324021
Telex: 44 14230 Hesna NL
(Importer)

Natuursteenhandel Granit Central BV
P O Box 726
2501 CA The Hague
Tel: 011-31-70-658804
Telex: 44 32458
(Importer)

Oostdan Natuursteen
P O Box 167
5060 AD Oisterwijk
Tel: (4242) 64542
Telex: 44 52572
(Importer)

Vialle Natuursteenindustrie
Hakkesstraat 39
5916 PX Venlo
Tel: 011-31-77-548500
Telex: 44 58554 Stone NL
(Stone Flooring Importer)

PORTUGAL

Dexportadora de Ardosias LDA
Lameira Ferreira
4440 Valongo
(Exporter)

SOUTH AFRICA

Keeley Sate PTY Ltd
P O Box 1052
Johannesburg 2000
Telex: 3 422351
(Exporter)

SPAIN

Antonio Sanchez Blanco
Espartero 26
El Ferrol
La Coruna

Cufica SA
Sobradelo de Valdeorras
Orense
Tel: 988-33-51-32/63/26

Cupire Padesa SA
Sobradelo de Valdeorras
Orense
Telex: 52 88179

Inlusa
Bretona S/N
Iglesia (a Pastoriza-Bretona)
Lugo
Tel: 982-34-92-03

Ipiga SL
Sobradelo de Valdeorras
Orense

Ipisa
Marcelino Suarez 24
Barco de Valdeorras
Orense
Telex: 52 88377

Jokin Sarasola
Plaza Centenario 6
San Sebastian
Guipuzcoa

Pizarras Forcadas SA
Avda Portugal 12
Ponferrada
Leon

Pizarras Samaca SA
El Trigal-Sobradelo
Orense
Telex: 52 88149

Proinor SA
Sobradelo de Valdeorras
Orense
Tel: 988-33-51-32/63/26

SWITZERLAND

Bargetzi and Biberstein AG
Baselstrasse 69
CH-4504 Solothurn
(Importer)

Berger and Co
Arnold Boecklin-Str 33
CH-4002 Basle
Tel: 011-41-61-54-01-02
(Importer)

Eckardt Natursteine AG
Seefeldstrasse 198
CH-8034 Zurich
Tel: 011-41-1-55-08-60
(Importer)

Frizzi Tomaso
Residenza Fontanascia
CH-6576 Gerra-Piano
(Importer)

Naku-Steinhandel AG
Hauptstrasse
CH-8255 Schlattingen
Tel: 011-41-53-786-57
(Importer)

Zuellig and Co AG
Bramenstrasse 10
CH-8184 Bachenbuelach
(Importer)

UK

Berwyn Slate Quarries Ltd
LLangollen
Clwyd
WalesTel: 011-44-978-860948

Alan Blunn Ltd
165 Rotherhithe Street
London SE16 1QU
England
Tel: 011-44-1-232-2926
Telex: 51 884176

Burlington Slate Ltd
Cavendish House
Coniston
Cumbria LA21 8ET
England
Tel: 011-44-996-41515
Telex: 51 65157 (BURCON G)

Cocklebank Conservations Ltd
(Twll Coed)
12 Townfield Road
West Kirby, Wirral
Merseyside
England
Tel: 011-44-51-625-8266

Cumbria Stone Quarries Ltd
Silver Street
Crosby Ravensworth, via Penrith
Cumbria CA10 3JA
England
Tel: 011-44-93-15227

Cwt-y-Bugail Slate Quarries Co Ltd
Pas-y-Bryn
Wynne Road
Blaenau Ffestiniog
Gwynedd LL41 3DR
Wales
Tel: 011-44-766-830204

Delabole Slate Ltd
Pengelly
Delabole, Cornwall
England
Tel: 011-44-840-212242

Elliott Bros Builders Merchants
Elliott Bros International
Millbank Street, Northam
Southampton SO9 2GR
England
Tel: 011-44-703-226852

UK (continued)

Goddfa Ganol Slate Mine
Blaenau Ffestiniog
Gwynedd LL41 3NB
Wales
Tel: 011-44-766-830664

J W Greaves & Sons Ltd (Portmadoc)
Llechwedd Slate Mines
Blaenau Ffestiniog
Gwynedd LL41 3BN
Wales
Tel: 011-44-766-830522

Allan Harris & Sons Ltd
Station Road, St. George's
Weston-super-Mare
Avon BS22 0XW
England
Tel: 0934-511-166
Telex: 51 449958 (ASLATE)

W H Humphreys (Tw11 Coed)
Sunny Side
Pen-y-Groes
Gwynedd
Wales
Tel: Penygroes 502 (evenings)

Kenold Slate Ltd
209 High Street
Hampton Hill
Middx TW12 1NR
England
Tel: 011-44-1-977-9261
Telex: 51 21656 (TEM LAWG)

Kirkstone Green Slate Quarries Ltd
Ambleside
Cumbria LA22 9NN
England
Tel: 05394-33296
Fax: 05394-34006

Stephen Lonsdale Ltd
Building L
Northfleet Industrial Estate
Lower Road, Northfleet
Kent DA11 9SN
England
Tel: 011-44-474-334950

Penryhn Quarries Ltd
Bethesda, Nr Bangor
Gwynedd LL57 4YG
Wales
Tel: 011-44-248-600656

Stan Robinson & Associates
18 Middleton Park Road
Leeds
W Yorks LS10 3ST
England
Tel: 011-44-532-711050

J H Rylance Ltd
Guide, Nr Blackburn
Lancs
England
Tel: 011-44-254-52244

Spanish Slate Quarries Ltd
301 Elveden Road
Park Royal
London NW10 7SS
England

Trevone Quarries Ltd
Bosahan Quarry
Constantine, Falmouth
Cornwall TR11 5QQ
England
Tel: 011-44-326-40604
Telex: 51 45665 (TREVON G)

Wincilate Ltd (Aberllefeni)
Victoria Docks
Caernarfon
Gwynedd LL55 1TF
Wales
Tel: 011-44-286-2252

USA

(See Appendices J2 and J3)

USA

(See Appendices J2 and J3)

USSR

V/O Strojmaterialintorg, Firm-Cement50 Korpz
Sokolnichesky Val
Moscow 107118
Telex: 64 411887 Str Su
(Exporter)

APPENDIX J2: US Slate Producers and Suppliers

COMPANY	LOCATION	
Alvis Schoepfel Marble Works		
*Anthony Dally & Sons Inc	Pen Argyl	PA
Appalachian Stone Inc	Duncannon	PA
*Arvonia-Buckingham Slate Corp	Richmond	VA
Burlington Natstone Inc	Plano	TX
*Burlington Slate Ltd	Worplesdon	Surrey, UK
Canterbury Stone Co Ltd	Christchurch	New Zealand
Cold Spring Granite Company	Cold Spring	MN
Battaglia Inc	Harbor City	CA
Delaware Quarries Inc	Lumberville	PA
Diamond Slate Co Inc	Pen Argyl	PA
Domestic Marble & Stone Corp		
Doney Slate Co Inc	Pen Argyl	PA
Eurocal Slate Centers		
Euromarble, USA	Lincoln	RI
Euromarble SPA	Carrara	Italy
Evergreen Slate Co Inc	Granville	NY
Gawet Marble & Granite Co Inc	Rutland	VT
Grearson & Lane Co	Barre	VT
Gregory Stone Co Inc	Dayton	OH
*H B Slate Products	Whitehall	NY
*Hilltop Slate Inc	Middle Granville	NY
Idaho Quartzite Corp	Boise	ID
Innovative Marble & Tile Inc	Farmingdale	NY
*Kirkstone Quarries	Ambleside	Cumbria, UK
*LeSueur-Richmond Slate Co.	Richmond	VA
Marmol Compac SA	Gandia	Valencia, Spain
Mid America Marble & Granite	St. Louis	MO
Musetti Raffo SRL	Carrara	Italy
*Penn Big Bed Slate Co Inc	Pen Argyl	PA
*Penrhyn Quarries Ltd	Bethesda	Gwynedd, UK
Rocky Mountain Stone Co Inc	Albuquerque	NM
*Screebs Slate & Stone Co Inc	Northampton	PA
*Sheldon Slate Products Co Inc	Middle Granville	NY
Solmar Stone AG	Ch-6300 Zug 2	Switzerland
The Stone Center	St Louis	MO
Stone NV	Londerzeel	Belgium
The Structural Slate Co	Pen Argyl	PA
Valley Marble & Slate	New Milford	CT
Vermont Structural Slate Co	Fair Haven	VT
Youngsworth Enterprises Ltd		

*denotes quarries

Source: Stone World Magazine, 1987
Dimensional Stone Magazine, 1986/87

APPENDIX J3: US Slate Importers/Distributors by State

STATE	COMPANY	LOCATION
California	Walker & Zanger	Glendale
	Battaglia Marble Inc	Harbor City
	Globe Marble & Tile Inc	North Hollywood
Florida	Ruck Brothers Brick Inc	Fort Meyers
	Ruck Brothers Brick Inc	Sarasota
	Natural Stones and Minerals Int'l Corp	Miami
Georgia	Marvin L Walker & Assoc	Norcross
Idaho	Idaho Quartzite Corp	Boise
Louisiana	The Stone Centre Inc	New Orleans
Maryland	Universal Marble & Granite Co	Baltimore
Massachusetts	Euromarble, USA	Boston
Michigan	Michigan Tile & Marble Co	Detroit
Nebraska	Universal Terrazzo & Tile Co	Omaha
New Jersey	Continental Creative Sales Inc	Garfield
New York	Sayegh Int'l Co Inc	Brooklyn
	Innovative Marble & Tile, Inc	Farmingdale
	Petrillo Stone Corp	Mt Vernon
	Domestic Marble & Stone Corp	New York
	Euromarble, USA	New York
	Walker & Zanger Inc	Scarsdale
	Westchester Marble & Granite	Scarsdale
North Carolina	Christina Marble Co	Raleigh
Ohio	Gregory Stone Co, Inc	Dayton
Pennsylvania	Delaware Quarries Inc	Lumberville
	Modena Inc	Pittsburgh
Rhode Island	Euromarble, USA	Lincoln
Texas	J Rios, Inc	Houston
	Houston Marble & Granite	Houston
	Busse Marble Co	Smithfield
Vermont	Gawet Marble & Granite Inc	Rutland

Source: Stone World Magazine
Dimension Stone Magazine

APPENDIX K: Selected Trade Associations

American Institute of Architects
1735 New Yrok Avenue NW
Washington DC
20006 USA
Tel: 202-626-7300

American Society of Interior Designers
1430 Broadway
New York, NY
10018 USA
Tel: 212-944-9220

Association of Roofing Manufacturers' Suppliers
Cisernos 6-1
39007 Santander
Spain
Tel: 022-34-42-224841/816057
Cedric Scheybeler

Building Stone Institute
420 Lexington Avenue
New York, NY
10170 USA
Tel: 212-490-2530

Consorzio Ardesiaco Ligure
Via Piana Mercato 5
16044 Monteleone di Cicagna
Genoa, Italy
Tel: 0187-815-029/816-489
Director: Ing Rocca

Construction Specifications Institute
601 Madison Street
Alexandria,VA
22314 USA
Tel: 703-684-0300

Expanded Shale, Clay & Slate Institute
6218 Montrose Road
Rockville, MA
20852 USA
Tel: 301-231-9497

Japan Building Stone Industrial Association
1-36-11 Asakusabashi
Taito-ku
Tokyo, Japan
Tel: 011-81-3-866-0543

Japan Building Wholesales Importer Association
151 Shimofujisawa
Iruma-shi
Saitama-ken
Japan
Tel: 0429-64-9145

Marble Institute of America Inc
33505 State Street
Farmington, MI
48024 USA
Tel: 313-476-5558
Fax: 313-868-7244 Wolverine Marble Co
Managing Director: Robert Hund

Materials & Methods Standards Association
315 S Hicks Road
Palatine, IL
60067 USA
Tel: 312-358-9500, Ext 239

National Building Material Distributors Association
1701 Lake Avenue, Suite 170
Glenview, IL
60025 USA
Tel: 312-724-6900

National Federation of Roofing Contractors
15 Soho Square
London W1V 4FB
England, UK
Tel:011-44-1-734-9164

National Slate Quarries Association
Bryn Llanllechid
Nr Bangor
Gwynedd
Wales, UK
Secretary: H A Pritchard

National Stone Centre
Wirksworth
Derbyshire DE4 4FR
England, UK
Tel: 022-44-629-82-4833
Director: Harry Robinson

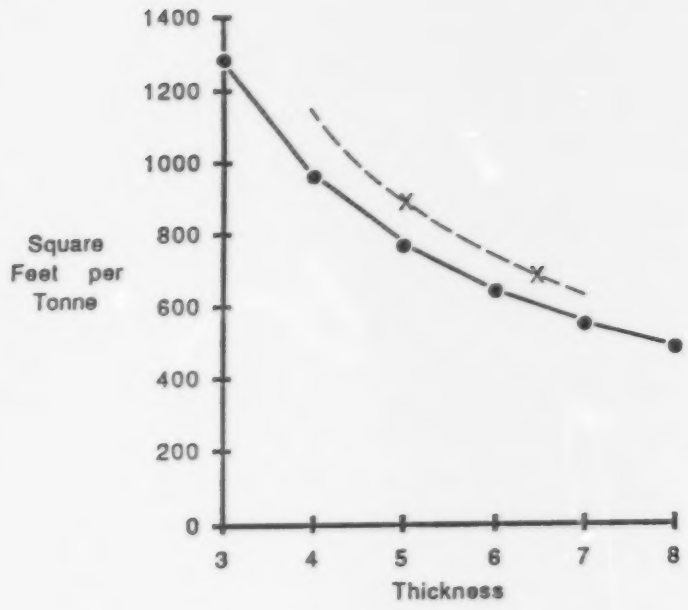
Spanish Mining & Quarrying Association
Pizarras Villar del Rey
Sinca El-Bodonal, Villar del Rey
Badajoz, Spain
Tel: 24-414-111
President: Julian Cuellar-Reynolds

The Stone Federation
82 New Cavendish Street
London, W1M 8AD
England, UK
Tel: 011-44-1-580-5588

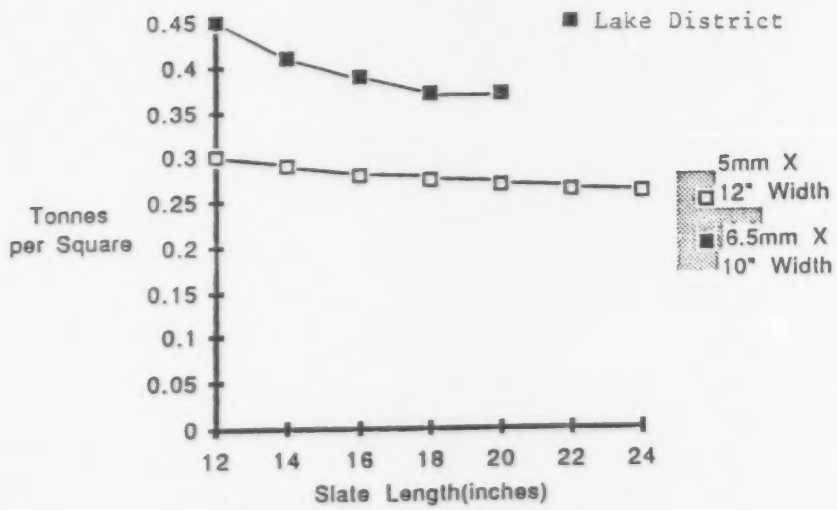
Tile Contractors Association of America
112 North Alfred Street
Alexandria, VA
22314 USA
Tel: 703-836-5995

APPENDIX L: Conversion Charts

Weight of Slate versus Plane Area and Thickness



Weight of Slate Roofing per Area of Laid Measure versus Thickness and Slate Size



APPENDIX M: Coverage Table
Sized Roofing Slate

Length, in	Slates/sq m laid measure
12in width	
24	12.3
22	13.6
20	15.1
18	17.1
16	20.0
14	23.5
12	28.2
10in width	
20	18.1
18	20.4
16	23.8
14	28.0
12	34.1
10	43.5
8in width	
16	29.5
14	34.9
12	42.0
10	54.0

APPENDIX N: Countries Importing Minor Quantites of Slate (1985)

1,000 - 2,000 tons

Norway
Switzerland
Eire
Andorra
Finland
Sweden
Japan

500 - 1,000 tons

New Zealand
Thailand
Spain

Less than 500 tons

Bahrain
Dubai
Oman
Guinea
Iraq
Taiwan
Equador
Chile
Malaysia
Saudia Arabia
Trinidad & Tobago
Singapore
South Yemen
Uraguay

APPENDIX O: Transportation Rates from Newfoundland

1. INDICATIVE FREIGHT RATES

DESTINATION	MODE OF TRANSPORT (C$)			
CANADA	RAIL[6]	ROAD	WATER[3]	NOTES
Montreal, Que	1,800	3,150	1,500*	*based on 50,000 lbs.
Bedford, Que	1,896	3,150	1,655*	
St. Catherine's, Ont	2,298	3,578	2,305*	
Toronto, Ont	2,124	3,510	2,125*	
UNITED STATES				
Granville, N.Y.	---	3,600	2,535+	+upper limit only 44,000 lbs per container. Water to Montreal then road home.
New York, N.Y.	---	3,600	4,109 2,671+	
Philadelphia	---	3,713	4,480 2,671+	
Chicago	---	4,950	3,168	
Tampa, Florida	---	5,400[1]	---	
Houston, Texas	---	10,125[2]	---	
Los Angeles	---	---	3,949	
UK/EUROPE: [4,5]				
Dublin, Ireland			4,900	
Hamburg, Germany			4,080	
Liverpool, England			4,302	
LeHavre, France			4,080	
Antwerp, Bremerhaven, Rotterdam, Gothenburg			4,080	

[1] regular run with back haul
[2] dedicated run
[3] scheduled container line: up 55,000/lbs
[4] Source: various company quotations
[5] 50 mile radius
[6] incl. subsidy

DESTINATION	MODE OF TRANSPORT (C$)			
PACIFIC	RAIL	ROAD	WATER	NOTES
Sydney, Australia	---	---	6,849[7]	
Hong Kong	---	---	3,689	
Yokohama	---	---	3,689	
Kobe	---	---	3,689	

[7] Container line quote: includes $475 to position container. C$1050 LLC to Halifax. US$4750 Halifax to Sydney.

NOTES:

A. Rail rates shown are based on a cost per 100 lbs. Prices quoted cover a 60,000 lb. shipment. A 60,000 lb. shipment attracts the lowest rate on the schedule.

B. Road rates shown are based on a cost per 100 lbs. Prices quoted cover a 45,000 lb. shipment. Increases or decreases in weight will increase or reduce the cost proportionately.

C. Water rates shown are based on a 40 ft container. Weight of cargo can vary between 45,000 - 60,000 lbs.

D. On shipments destined for overseas and U.S. ports, there may be an additional charge of $475.00 to position a container if one belonging to the shipping company is not on the island. In most cases, this can be overcome by scheduling shipments with a company regularly doing business in the Province.

E. The cost of transporting shipments within Canada may be reduced by various transportation subsidies (See Appendix P).

F. It is extremely important to maximize the weight of the container or trailer as the rail and road rates are based on 60,000 lbs. and 45,000 lbs. minimum. The waterhaul is per container and weights vary from 45,000 lbs. - 60,000 lbs.

2. Oil Prices

An increase in world oil prices will clearly have an adverse effect on freight costs. The transportation industry may reintroduce the fuel adjustment charge as a separate cost factor on freight movements. At the height of the crisis of recent years, this charge reached a maximum of 2.5 per cent of scheduled rates.

3. Discontinuation of Rail Freight Service in Newfoundland

It is difficult to determine what effect the discontinuance of the railway will have on the cost of shipping and receiving freight to and from Newfoundland.

The rates as shown in the attached schedule show the rail costs as considerably cheaper than the other modes except asterisked waterhaul rates. However, Terra Transport has been ordered to raise their rates to a more compensatory level, the official opinion being that the rates are artifically low. It appears that with or without the railway, the rates will rise. However, a best guess is that its continuing presence would serve to keep rates more stable in the industry.

4. Anticipated Freight Rate Adjustments

In discussion with various transportation companies, we have had varied responses to anticipated increases over the next five years. Some of the companies make adjustments every two to three years whilst others try to stay in line with the annual C.P.I. figures. Increases are regulated to a large extent and therefore must meet some logical criteria. On the basis of information provided on past years and projections for future years, we feel that a 12 per cent increase overall is a reasonable figure for the next five years for normal freight rate adjustments.

5. Chartering Possibilities for Full Load Cargoes Outward

The very best opportunity for exports of cargo from Newfoundland is the utilization of chartered vessels carrying freight into the Province with no return cargo. Shipowners would look upon this with favour allowing them to make a significant contribution towards expenses. The Hardwoods Plant at Clarenville regularly charters vessels to bring in poles and large timbers and there is no return cargo. Vessels carrying equipment for large hydro projects also make occasional calls. In addition, chartered vessels are continuously passing by the Province on their way to Halifax and into Great Lakes ports.

Consideration should also be given to utilizing the empty deck space of vessels leaving ports such as Long Harbour, Botwood and Corner Brook for trial shipments into new markets.

The chartering of a vessel on a dedicated basis is a costly project and depends on many factors including the state of the market at the time of contract. Costs at the loading and discharging ports are considered as well as the location and distance between ports. Each charter party is negotiated with all those factors in mind.

An example of a charter party for a one way cargo to Newfoundland specified:

> Vessels to load and transport 6,800 long tons cargo. Cargo to be loaded, stowed and discharged at owners expense.

Freight Rate: 1st Port of Discharge
2,500 long tons @ US$58.00 per long ton.

2nd Port of Discharge
4,300 long tons @ US$50.00 per long ton.

Vessel to be loaded and discharged at the rate of 1,500 long tons of per weather working day.

Total cost to the shipper of the cargo for freight, 360,000 US plus stevedoring, port charges and insurance could be much higher in a good market situation.

6. Loading Site at Lower Lance Cove or Quarry on Completion of Road

The loading operation onto trailers or containers is handled by a set of forks which are operated in conjunction with a crane truck. This should not be confused with a standard forklift machine.

The pallets which have been used measure 52 x 44in, weighing approximately 1.5 tons. In shipping a cargo of slate roof tiles by container using these pallets great difficulty is experienced in manoeuvering the pallets within the container. The inside dimensions of the container are 90 in x 90 in.

It is imperative that the site of loading be equipped with handling equipment that can load efficiently the containers or trailers provided by the transportation company. Planning should also be undertaken to standardize the pallets and determine the best type of container or trailer for these cargoes.

Source: Q Nav Marine Ltd., St. John's.

APPENDIX P: Atlantic Region Freight Assistance Program

The transportation assistance program falls into three distinct parts covering: (1) intra-regional shipments; (2) westbound shipments of all commodities and, (3) westbound shipments of selected commodities. A brief description of the application of the assistance in relation to each of these categories follows:

Intra-Regional Subsidy Program

This program provides a 10 per cent reduction in rates for the movement of an approved list of goods that have been manufactured or produced in the Atlantic Region. The carriers are reimbursed by the CTC for the reduction. The minimum eligible billing for the intra-regional subsidy is C$50.00. The subsidy applies to shipments between points in the select territory[1] moving via rail, for-hire truck, water and air modes, providing the carrier has applied for and been granted certification by the Canadian Transport Commission. The subsidy is paid directly to the carrier. To be eligible for the assistance, carriers are required to reflect the subsidy as a reduction in their tariff of rates and, unless otherwise authorized by the shipper, to include particulars of the gross freight charges, amount of subsidy, and net freight charges on revenue freight bills submitted to shippers.

Basic Westbound Subsidy Program

This program provides a reduced rate level for the movement of virtually all goods via rail and for-hire truck originating in the Atlantic Region (select territory) and movingwestbound to points in Canada outside the Atlantic Region. The subsidy is applicable regardless of the nature of the commodity and is automatically reflected in the rates published by the carriers. No action is required on the part of the shipper to obtain the benefit of this basic subsidy. The amount of the basic subsidy is 30 per cent based on the proportion of the distance in the Atlantic Region to the total distance of the shipment. To illustrate, a rate on a shipment originating 500 miles east of Levis and destined to a point 500 miles west of Levis would reflect a reduction of 15 per cent, or one-half of the percentage factor of the basic westbound subsidy.

[1]The select territory is defined as the Provinces of New Brunswick, Nova Scotia, Prince Edward Island and the Island of Newfoundland, as well as that part of the Province of Quebec that is east of Levis and south of the St. Lawrence River.

Selective Westbound Subsidy Program

This program provides an additional reduction (based on a 20 per cent factor) over and above the basic 30 per cent westbound subsidy. It applies to the movement of a selected list of eligible commodities from points in the Atlantic Region to destinations in other parts of Canada. Similar to the basic subsidy, the amount of the selective westbound subsidy is based on the proportion of the distance in the Atlantic Region to the total distance of the shipment. In other words, if the distance in the Atlantic Region is one-half the total distance, then the amount of selective westbound subsidy will be 10 per cent. The minimum eligible billing for the selective westbound subsidy is C$100.00 The selective westbound subsidy is payable to both railways and for-hire truckers in return for reducing their rate by amounts authorized by the Canadian Transport Commission. In addition to the list of eligible commodities, additional commodity coverage is included periodically in response to applications from regional shippers to the Federal/Provincial Committee on Atlantic Region Transportation. Eligible commodities included unprocessed agricultural and fisheries products, along with commodities manufactured or processed in the region for which the full potential for adding value is achieved within the region and which generate significant economic activity.

Source: Atlantic Provinces Transportation Commission

NOTE: Eligibility of worked slate products for the selective Westbound subsidy was confirmed by Order in Council, November 1987.

APPENDIX R-1: Customs Values of US Imports Roofing Slate

For derivation of short tons and tonnes from customs values of US imports.

A. CUSTOMS VALUES into US.
US Dept. of Commerce trade statistics 1985

	US$/sq ft	sq ft(000)	US$(000)
UK	1.43	132	189
Spain	0.63	516	326
Portugal	0.57	184	105
China	0.31	834	259
Total	-	1,666	879

weighted average unit value US$0.53/sq ft

Assume average nominal thickness	=	5.0mm
Square feet per tonne (Appendix L)	=	770 approx.
Square feet per short ton	=	700 approx.

Calculated value on the above basis

US$ 371/ST
and C$ 547/tonne

B. CIF VALUES of the above imports US$(000)

	UK	219
	Spain	458
	China	457
assume	Portugal	148
	Total	1,282

Weighted average unit values:

US$ 0.87/sq ft
US$ 608/ST
C$ 898/tonne

APPENDIX R-2: Values of US Imports Non-Roofing Slate

Assumptions for derivations of tonnage figures.

1. Pool Table Slate

   Assume 12 ft x 6ft x 1x¾in CIF $425
   Equivalent to US$470/ST.

2. Flooring

   Assume US $1.00/sq ft ½in ungauged
   sq ft/ST = 278 = US$/ST.
   If assume 3/8in ungauged
   sq ft/ST = 371 = US$ST
   Average = 325 US$/ST

3. Architectural

   Rule of thumb for an average value: US$0.35/lb including engineering & technical service.

4. Overall

   Assume: imports 60% Italian
   - Italian imports are 83% pool table.
   - Architectural is 15% of imports.
   - Flooring is balance.

   Then: pool table 0.50 @US$400
   architectural 0.51 @US$700
   flooring 0.35 @US$325

   Weighted value (approx) US$420/ST

APPENDIX Q: Flooring Slate Price List
Canadian Supplier: C$/sq ft FOB Plant, FST extra

A. Gauged 1/4in	<9in	9 x 9in	12 x 12in	16 x 16in
Black	2.50-3.00	2.50-3.00	3.00-3.70	3.00-3.70
Red	2.80-3.60	3.40-4.10	4.00-4.70	4.00-4.70
Grey	1.60-2.20	2.00-2.60	2.60-3.20	3.60-4.40
Purple	1.60-2.20	2.00-2.60	2.60-3.20	3.60-4.40
Green	1.60-2.20	2.00-2.60	2.60-3.20	3.60-4.40
B. Gauged 3/8in				
Black	3.00-3.80	3.00-3.60	3.60-4.40	3.60-4.40
Red	3.30-4.30	4.00-4.90	4.60-5.50	4.60-5.50
Gre;y	1.90-2.60	2.40-3.10	3.10-3.80	4.30-5.20
urple	1.90-2.60	2.40-3.10	3.10-3.80	4.30-5.20
Green	1.90-2.60	2.40-3.10	3.10-3.80	4.30-5.20
C. Ungauged 1/4in				
Black	2.30-3.00	2.30-3.00	2.80-3.50	2.80-3.50
Red	2.60-3.40	3.20-3.90	3.70-4.40	3.70-4.40
Grey	1.40-2.00	1.80-2.40	2.40-3.00	3.40-4.20
Purple	1.40-2.00	1.80-2.40	2.40-3.00	3.40-4.20
Green	1.40-2.00	1.80-2.40	2.40-3.00	3.40-4.20
D. Ungauged 3/8in				
Black	2.30-3.00	2.30-3.00	2.80-3.50	2.80-3.50
Red	2.60-3.40	3.20-3.90	3.70-4.40	3.70-4.40
Grey	1.40-2.00	1.80-2.40	2.40-3.00	3.40-4.20
Purple	1.40-2.00	1.80.2.40	2.40-3.00	3.40-4.20
Green	1.40-2.00	1.80-2.40	2.40-3.00	3.40-4.20

APPENDIX S: Examples of Slate Shipments Entering the Port of Los Angeles February 1986 - July 1987

ITEM	ORIGIN	DESTINATION	TONS
Slate	Japan	California	198
Beijing Slate	China P	California	17
Black Slate	China P	California	50
Black Slate	Hong Kong	California	59
Floor Slates	India	California	22
Green Roof Slates	Spain	California	40
Green Slate	China P	California	16
Grey Roof Slates	China P	California	27
Pizarras	Netherlands	California	162
Light Green Slate	United Kingdom	California	2
Multicolour Med Ungauged Sawn Slate	India	California	20
Multicolour Slate	China T	California	20
Roof Slates 2 Holes	Hong Kong	California	36
Roof Slates 2 Holes	China P	California	51
Roof Slates Drilled	China P	California	18
Roofing Slate	China P	Indiana	34
Rough Slate	Netherlands	California	41
Slate	China P	California	15
Slate	China P	California	1,107
Slate	Hong Kong	California	17
Slate	Japan	California	16
Slate Flakes for Roofing	FR Germany	California	37
Slate Powders	Belgium	California	74
Slate Rough Cut	Rep S Africa	California	21
Slate Slabs	France	California	21
Slate Slabs	Italy	California	35
Slate Tiles Mission & Accessories	New Zealand	California	17
Slate Waste	France	California	74
Slates H 15	Italy	California	74
Slate Rough Cut	Belgium	California	20
Wiltshire Slate	United Kingom	California	24
Flooring Slate	Rep S Africa	California	80
Rough Flooring Quarry Slate	Rep S Africa	California	23
Light Green Slate	United Kingdom	Montana	60
Slate	China P	New York	103
Slate	Brazil	California	36
Square Metres Slate Samples	Rep S Africa	California	20
Slate Slabs	Italy	California	952
Black Roofing Slate	China P	California	15
Flammet Quartzite Slate Stone	Sweden	Indiana	59
Multicolour Ungauged Sawn Slate	India	California	20
Olive Green Burlington Slate	United Kingdom	California	21
Slate	China P	California	569
Slate Random	China P	California	17
Burlington Blue Black Slate	United Kingdom	Washington	52

Source: Port of Los Angeles Special Search.
China P: People's Republic of China
China T: Republic of China (Taiwan)

APPENDIX T: US Exports of Slate 1986

Schedule B	Value (US$)
5151620 SLATE, ROUGH, WASTE AND POWDER	
FRG	4,030
Japan	7,740
TOTAL	11,770
5151630 SLATE, BUILDING ARTICLES	
Canada	60,860
Bahamas	5,750
Turks Is	1,011
Cayman Is	15,000
Saudi Arabia	23,431
Japan	3,475
Pacific	8,919
TOTAL	118,446
5151640 ARTICLES OF SLATE, NSPF*	
Canada	341,568
Mexico	19,844
El Salvador	2,721
Honduras	9,903
Panama	2,515
Bermuda	4,000
Bahamas	1,165
Cayman Is	1,180
LW WW I	4,618
Trinidad & Tobago	20,812
N Antilles	5,184
Colombia	45,968
Ecuador	4,325
Uruguay	3,475
UK	1,400
Ireland	2,700
France	7,483
FRG	81,730
Switzerland	8,703
Italy	1,094
Israel	14,469
Kuwait	23,161
Saudia Arabia	183,680
Bangladesh	2,220
Singapore	65,375
Indonesia	14,350
China P	1,580
Korean Republic	32,706
Japan	55,527
Sierra Leone	1,782
Other West Africa	1,782
TOTAL	967,100

*Not specifically provided for

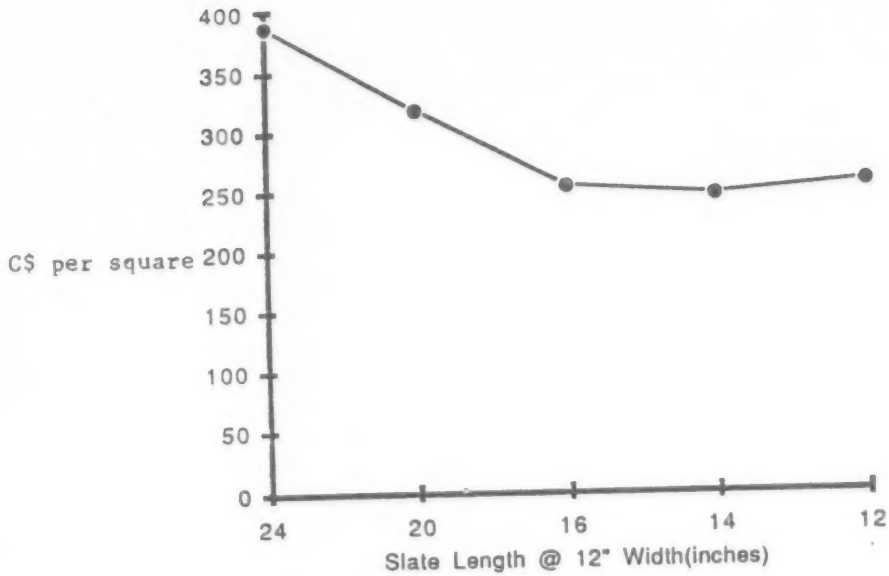
APPENDIX U: UK Trade Statistics 1984 - 1986 (tonnes and Canadian dollars)

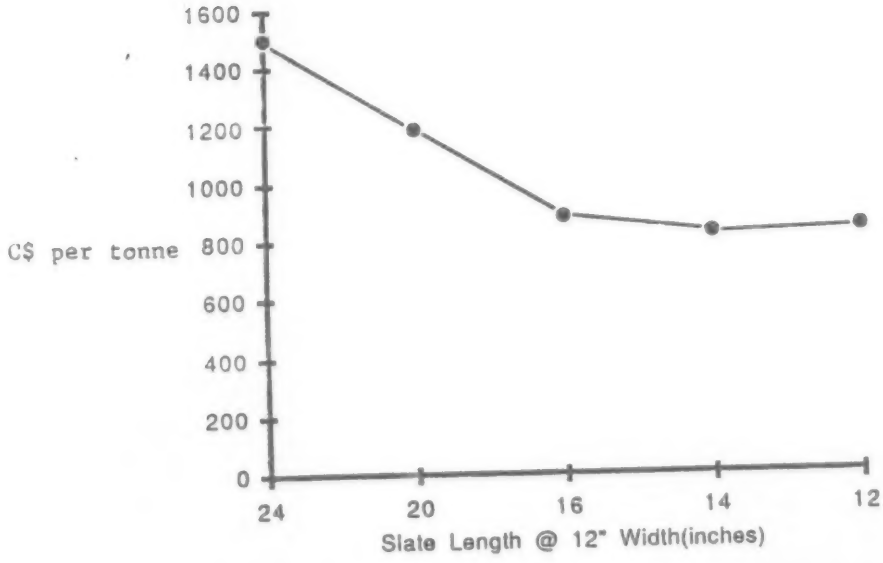
	1984				1985				1986			
	IMPORTS		EXPORTS		IMPORTS		EXPORTS		IMPORTS		EXPORTS	
Code No.	tonnes	C$	tonnes	C$	tonnes	C$	tonnes	C$	tonnes	C$	tonnes	C$
6803 1100	15,006	5,585,558	1,959	1,530,071	14,048	5,267,693	1,618	1,592,373	19,245	8,983,020	1,375	1,266,313
6803 1600	8,935	6,118,963	1,072	1,185,668	6,403	3,823,490	2,663	4,009,923	6,974	6,728,970	1,287	3,176,259
6803 9000	1,950	1,290,910	563	513,109	1,528	918,967	495	458,424	1,877	1,630,218	649	796,947
6803 TOTAL	25,891	2,995,431	3,592	3,228,842	21,979	10,010,150	4,776	6,060,720	28,096	17,342,208	3,311	5,239,518
2514 TOTAL	179	38,413	9,760	737,162	406	133,787	5,384	680,954	495	304,525	1,778	296,022
TOTAL SLATE	26,070	13,033,844	13,352	3,966,010	22,385	10,143,937	10,160	6,741,674	28,591	17,646,733	5,089	5,535,540

Source: British Government Statistics

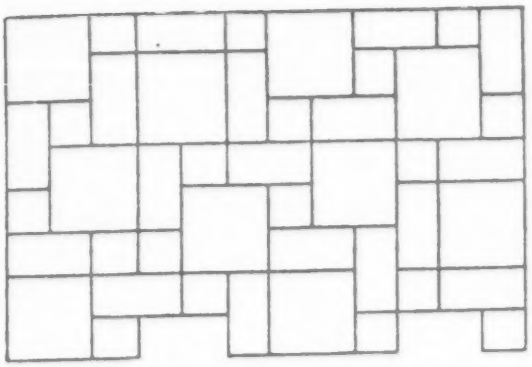
APPENDIX V: Roofing Slate UK

Best Sized Slates
Variation of Price with Size
1986 - 87

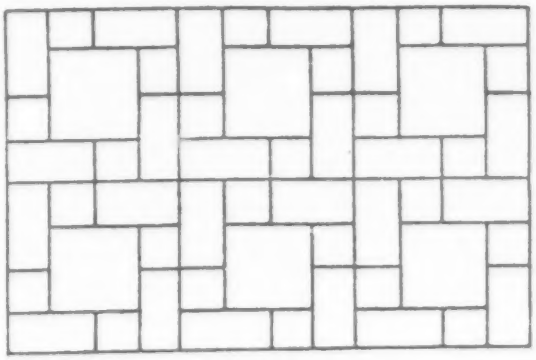




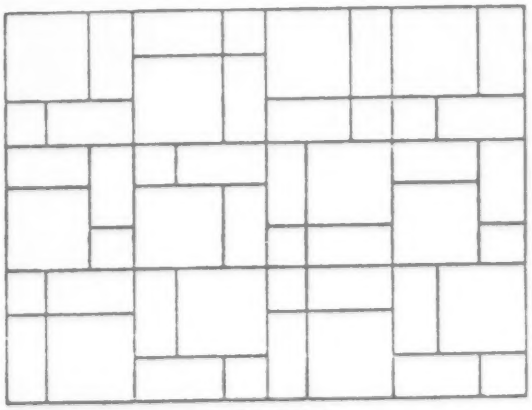
APPENDIX W: Selected Packaged Tile Patterns
Some variations of Block Random (3 sizes; 1-9 colours)



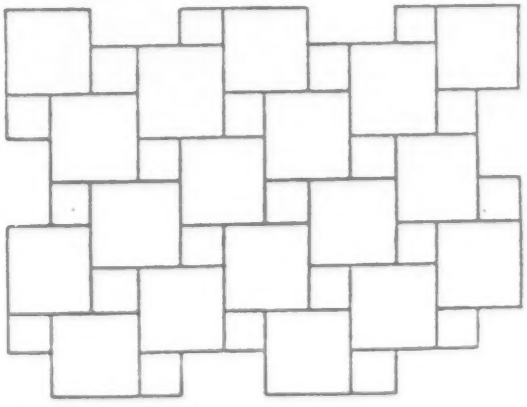
BLOCK RANDOM
Shown: 3⅞ x 3⅞ (19%), 3⅞ x 8 (35%), 8" x 8 (46%)



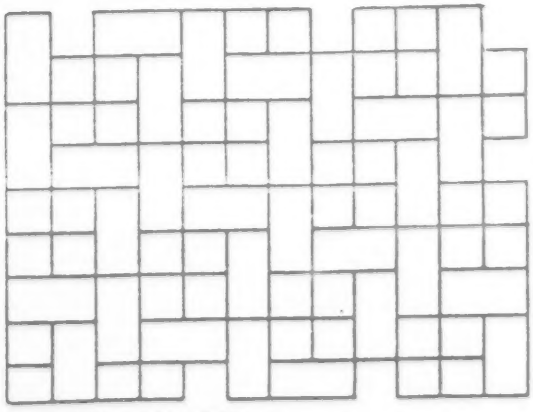
BLOCK RANDOM SQUARE
Shown: 3⅞ x 3⅞ (25%), 3⅞ x 8 (50%), 8 x 8 (25%)



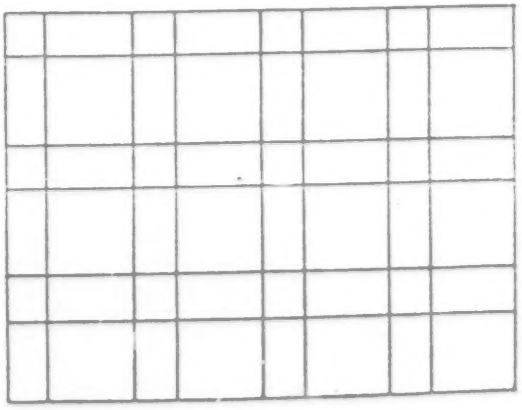
BLOCK RANDOM VARIATION
Shown: 3⅞ x 3⅞ (11.2%), 3⅞ x 8 (44.4%), 8 x 8 (44.4%)



RANDOM SQUARE
Shown: 3⅞ x 3⅞" (19½%), 8" x 8" (80½%)



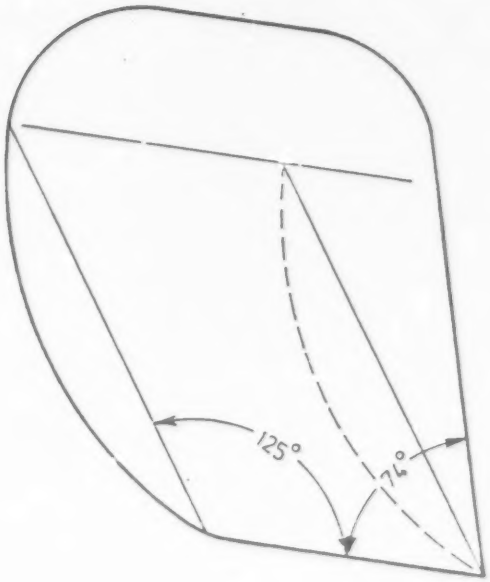
RAMBLING SQUARES
Shown: 3⅛" x 3⅛" (40%), 3⅛" x 8" (60%)
Also Use: 6" x 6" (40%), 6" x 12⅛" (60%)

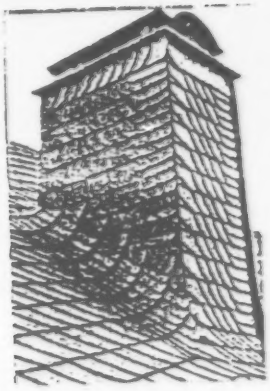


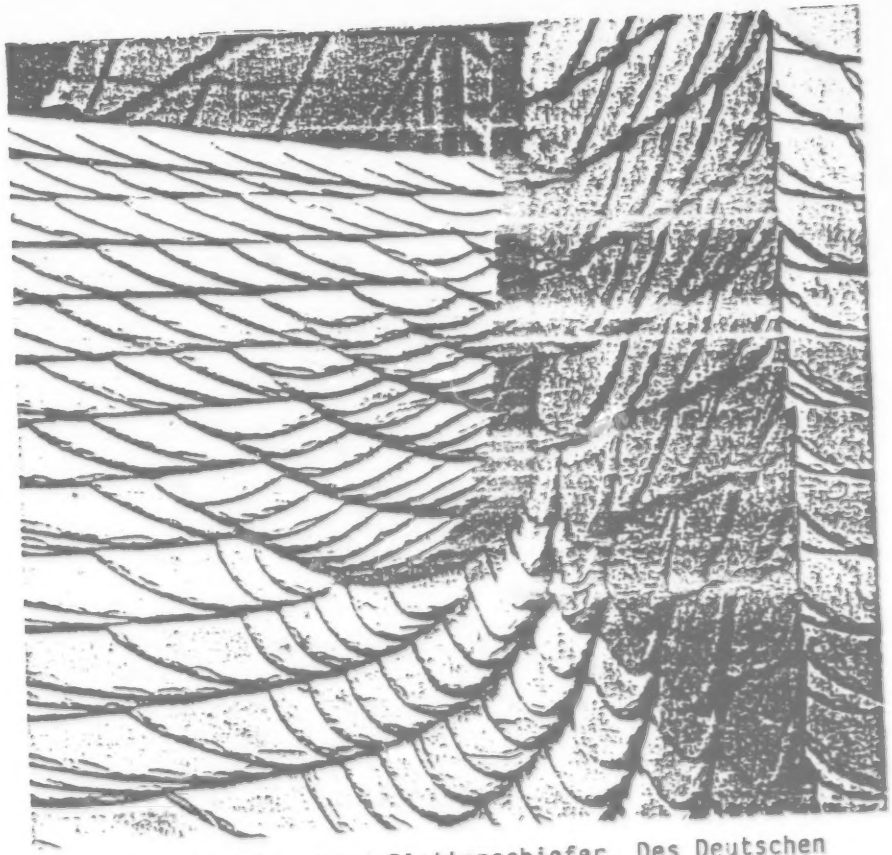
FORMAL RANDOM
Shown: 3⅛" x 3⅛" (11.2%), 3⅛" x 8" (44.4%), 8" x 8" (44.4%)

Source: D. White

APPENDIX X: "Flake" Shaped Roofing Tiles (FRG)

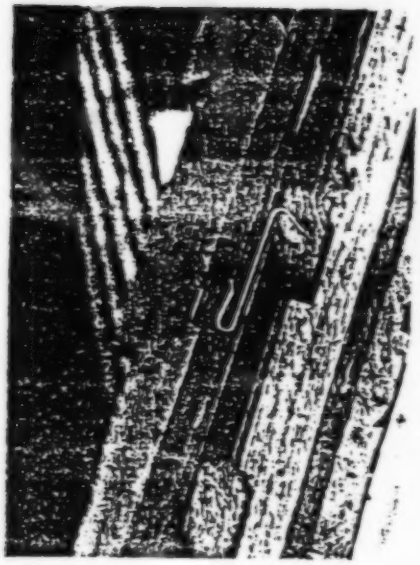


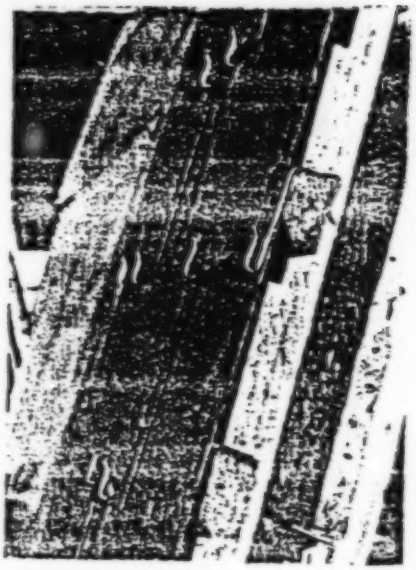


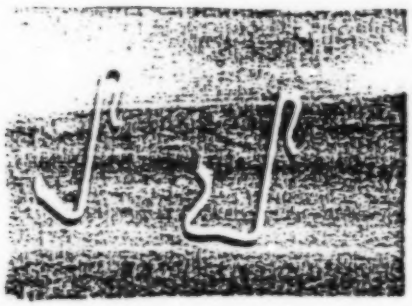


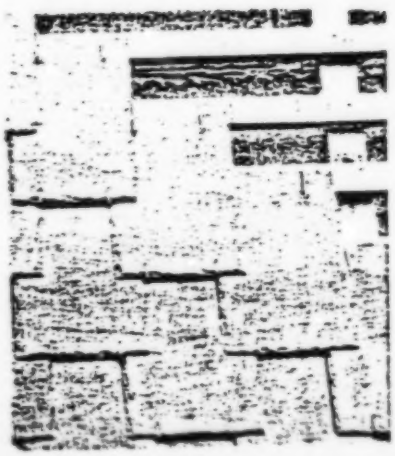
Source: Handbuch fur Dach-, Wand-Plattenschiefer, Des Deutschen Schieferbergbaues.

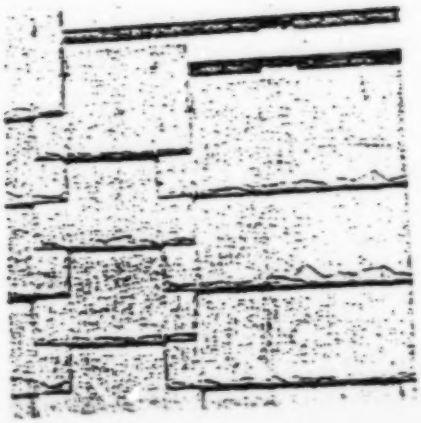
APPENDIX Y: Roofing Slate Hooks (FRG)











Source: Handbuch fur Dach-, Wand-Plattenschiefer, Des Deutschen Schieferbergbaues.

APPENDIX Z: Terms of Reference

STATEMENT OF WORK: Determine and quantify present and future markets for slate products by use and specifications, addressing the following:

1. Determine present consumption and uses of slate products.
2. Identify present producers, major users and those involved in the marketing of slate products. Supply names, addresses and telephone numbers.
3. Determine the relationship between producers and/or marketers and the end users, particularly noting the level of integration and the contractual arrangements.
4. Determine the specifications and standards for all identified end uses (size, thickness, colour, level of tolerated contamination, for example).
5. Determine the level of processing necessary for each demand category.
6. Determine uses for which slate may be substituted for other commodities.
7. Determine those commodities which could be substitute for slate.
8. Investigate the trend in demand and prices of slate products.
9. Investigate the effect of substitute pricing on slate demand trends.
10. Determine the difficulties in accessing markets given the relationship between producers and major users.
11. Determine the cost of transportation from deposits in Newfoundland and Labrador to identified markets.
12. Determine the effect of currency value fluctuation on export markets.
13. Determine applicable tariffs and their effect on export markets.
14. Determine possible future uses for slate products (including waste product as filler material) and those uses being researched.
15. Identify groups and individuals planning to and currently researching diversified uses for slate products.
16. Outline a plan to investigate and research product development.
17. Design a marketing strategy to promote development and market access.
18. Provide indicators and describe the methodology used to arrive at estimates of future demand for slate and indicate confidence level.
19. Describe major changes foreseen in the use of end products that could

affect the consumption of slate products.

20. Determine the effects of new methods of production and new processing technology on consumption and on costs.

21. Address other factors that could influence slate consumption, short and long term.